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# University of Arizona Record

## THE ANNUAL CATALOG 1913-14

WITH ANNOUNCEMENTS FOR  
1914-15

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PUBLISHED BY THE  
UNIVERSITY OF ARIZONA  
TUCSON, ARIZONA

Since the earlier sheets of this catalog were printed the Board of Regents of the University has been reconstituted, as follows:

#### EX-OFFICIO

HIS EXCELLENCY, GEORGE W. P. HUNT,.....Phoenix  
Governor of Arizona.

THE HONORABLE CHARLES O. CASE.....Phoenix  
Superintendent of Public Instruction, Secretary.

#### APPOINTED

FRANK H. HEREFORD, President of the Board, and Chan-  
cellor.....Tucson

LOGAN W. WHEATLEY, Treasurer.....Tucson

LEWIS D. RICKETTS.....Warren

WILLIAM SCARLETT.....Phoenix

RODERICK D. KENNEDY.....Globe

WILLIAM V. WHITMORE.....Tucson

RUDOLF RASMESSEN.....Tucson

FRANK G. DUFFY.....Nogales

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### CIRCULARS OF THE UNIVERSITY.

Circulars issued by the University will be forwarded on application to the President of the University. They include:

The Annual Catalog,

The Annual Report of the Regents,

"Why Go to College?"

Monthly editions of the University Bulletin, issued often in the form of broadsides, containing current news of the University,

"Arizona Life," the student newspaper,

"The Desert," the student annual, the price being \$2.25 the copy.

~~Withdrawn~~

# The University of Arizona

## THE ANNUAL CATALOG 1913-14

WITH ANNOUNCEMENTS FOR  
1914-15

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TUCSON, ARIZONA

1914

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## CALENDAR

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1914-15

### FIRST SEMESTER

Sept. 18, 19, Friday and Saturday	Matriculation and registration of new students
Sept. 21, Monday	Registration of old students
Sept. 22, Tuesday	Class work begins
Oct. 3, Saturday	Condition examinations
Nov. 10, Tuesday afternoon to Nov. 14, Saturday evening	Annual Encampment of the Battalion
Nov. 26, Thursday	Thanksgiving Day
Dec. 22, Tuesday evening to Jan. 3, Sunday evening	Christmas recess
Jan. 9, Saturday	Condition examinations
Jan. 27-30, Wednesday to Saturday	Semester examinations

### SECOND SEMESTER

Feb. 1, Monday	Class work begins
Feb. 22, Monday	Holiday
April 5-10, Monday to Saturday	University Week. Classes will be suspended Wednesday to Saturday, inclusive
May 15, Saturday	Condition examinations
May 26-29, Wednesday to Saturday	Semester examinations
May 31, Monday	Senior Day
June 1, Tuesday	Commencement

# OFFICERS OF ADMINISTRATION, INSTRUCTION AND INVESTIGATION

## BOARD OF REGENTS

### EX-OFFICIO

HIS EXCELLENCY, GEORGE W. P. HUNT.....Phoenix  
Governor of Arizona

THE HONORABLE CHARLES O. CASE.....Phoenix  
Superintendent of Public Instruction, Secretary

### APPOINTED

ALBERT L. WATERS, President and Chancellor.....Tucson  
FRANK H. HEREFORD, Treasurer.....Tucson  
LOGAN W. WHEATLEY.....Tucson  
LEWIS D. RICKETTS.....Warren  
WILLIAM J. SCARLETT.....Phoenix  
RODERICK D. KENNEDY.....Globe

## FACULTY

ARTHUR HERBERT WILDE, Ph. D., President. President's House  
B. A. 1887, Boston Univ.; M. A. 1899, Ph. D. 1901, Harvard  
Professor of History. †1911

ROBERT HUMPHREY FORBES, M. S. 105 Olive Road  
B. S. 1892, M. S. 1895, Illinois  
Director and Chemist, Agricultural Experiment Station. Direc-  
tor of Agricultural Instruction. 1894

FRANK NELSON GUILD, M. S. 107 Olive Road  
B. S. 1894, M. S. 1903, Vermont  
Professor of Chemistry and Mineralogy. 1897

GEORGE EDSON PHILIP SMITH, C. E. 1195 Speedway  
B. S. 1894, C. E. 1899, Vermont  
Irrigation Engineer, Experiment Station. 1900

JOHN JAMES THORNBURGH, A. M. 109 Olive Road  
B. S. 1895, So. Dak. Agr.; B. S. 1897, A. M. 1901, Nebraska  
Professor of Biology; Botanist, Experiment Station. 1901

† Date following titles indicates year of appointment to service in  
the University.

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- CHARLES ALFRED TURRELL, A. M. 835 Tyndall Ave.  
B. S. 1896, Nebraska; A. M. 1901, Missouri  
Professor of Romance Languages. 1904
- \*WILLIAM WHEELER HENLEY, A. B. First St. near Vine St.  
A. B. 1905, Stanford  
Professor of Mechanical Engineering and Mechanic Arts. 1905
- ALBERT EARLE VINSON, Ph. D. 627 E. First St.  
B. S. 1901, Ohio State; Ph. D. 1905, Gottingen  
Biochemist, Experiment Station. 1905
- FREDERICK W. WILSON, M. S. First and Vine Sts.  
B. S. 1905, Kansas (Agricultural)  
Professor of Animal Husbandry. 1905
- ANDREW ELLICOTT DOUGLASS, Sc. D. 1189 Speedway  
A. B. 1889, Sc. D. 1908, Trinity  
Professor of Physics and Astronomy. 1906
- LESLIE ABRAM WATERBURY, C. E. 1405 Speedway  
B. S. 1902, C. E. 1905, Illinois  
Professor of Civil Engineering. 1907
- \*ROBERT RHEA GOODRICH, M. S.  
B. S. (Mining) 1885, B. S. (Mechanical Eng.) 1901, M. S. 1902,  
Mass. Inst. of Technology  
Professor of Metallurgy. 1907
- \*ROBERT WAITMAN CLOTHIER, M. S.  
B. S. 1897, M. S. 1899, Kansas (Agr.)  
Professor of Agriculture. 1907
- ERNEST SUTHERLAND BATES, Ph. D. 908 Speedway  
A. B. 1902, A. M. 1903, Michigan; Ph. D. 1908, Columbia  
Professor of English. 1908
- HENRY ALFRED ERNEST CHANDLER, B. S. East Cottage  
B. S. 1905, Northwestern  
Professor of Economics and History. 1908
- GEORGE FOUCHE FREEMAN, B. S. 641 N. Park Ave.  
B. S. 1903, Alabama Polytechnic Institute  
Plant Breeder, Experiment Station. 1909

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\* On leave 1913-14.



- AUSTIN WINFIELD MORRILL, Ph. D. 235 W. Monroe St., Phoenix  
B. S. 1900, Ph. D. 1903, Mass. Agricultural College  
Entomologist, Experiment Station. 1909
- FRANCES MELVILLE PERRY, A. M. 1207 Speedway  
B. A. 1891, A. M. 1893, Butler  
Professor of English. 1910
- CHARLES ARTHUR MESERVE, Ph. D. 432 Speedway  
B. S. 1895, Mass. Inst. of Tech.; Ph. D. 1899, Univ. of Erlangen  
Professor of Bacteriology and Food Chemistry. 1912
- CHARLES HORACE CLAPP, Ph. D. 824 N. Euclid Ave.  
S. B. 1905, Ph. D. 1910, Mass. Inst. of Tech.  
Professor of Geology. 1913
- GEORGE LEROY BROWN, U. S. A. South Hall  
Colonel U. S. A. 1872, West Point  
Professor of Military Science and Tactics. 1913
- WILLIAM SLEEPER ALDRICH, M. E. 639 N. Park Ave.  
U. S. Naval Academy, 1883; M. E. 1884, Stevens Inst. of Tech.  
Acting Professor of Mechanical and Electrical Engineering.  
1913
- WILLIAM HEREFORD LAWRENCE, M. S. 826 E. Fourth St.  
B. S. 1899, So. Dak. Agr. Coll.; A. B., M. S. 1902, Washington  
State Coll.  
Horticulturist, Experiment Station. 1913
- STANLEY FLETCHER MORSE, B. A. S. 127 E. Third St.  
B. A. S. 1906, Harvard  
Acting Professor of Agriculture and Acting Agriculturist. 1913
- PAUL HENRY MALLET-PREVOST BRINTON, M. S. 115 Olive Road  
1909, Graduate of Chemisches Laboratorium Fresenius, Wies-  
baden; B. S. 1911, M. S. 1912, Minnesota  
Associate Professor of Chemistry. 1912
- LLOYD LYNE DINES, Ph. D. Arizona Hall  
A. B. 1906, A. M. 1907 Northwestern; Ph. D. 1911, Chicago  
Associate Professor of Mathematics. 1913
- \*MARION CUMMINGS STANLEY, M. L.  
B. L. 1900, M. L. 1909, California  
Assistant Professor of Philosophy. 1902

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\* On leave, 1913-14

- LEVONA PAYNE NEWSOM, Ph. D. 804 E. Fourth St.  
A. B. 1892, Ph. D. 1895, Franklin  
Assistant Professor of Latin and Greek. 1905
- WILLIAM GEORGE MEDCRAFT, A. M. 726 E. Fifth St.  
A. B. 1898, A. M. 1904, Kansas Wesleyan  
Assistant Professor of Mathematics. 1905
- ALEXANDER McOMIE, B. S. Experiment Station Farm, Phoenix  
B. S. 1910, Utah  
Assistant Agriculturist, Experiment Station. 1910
- FRANK CALEB KELTON, B. S. 412 E. Fourth St.  
B. S. 1904, Arizona  
Assistant Professor of Civil Engineering; Registrar. 1907
- ESTELLE LUTRELL, A. B. 731 No. First Ave.  
A. B. 1896, Chicago  
Assistant Professor of English, Librarian. 1904
- ARTHUR HAMILTON OTIS, A. B. 639 N. Park Ave.  
A. B. 1908, Columbia  
Assistant Professor of Germanic Languages. 1911
- CHARLES FRANCIS WILLIS, B. S. 725 E. Fourth St.  
B. S. 1906, Mass. Institut of Technology  
Assistant Professor of Mining Engineering; Director, Bureau  
of Mines. 1912
- IDA CHRISTINA REID, Ph. M. Pima Hall  
Ph. B. 1906, Arizona; Ph. M. 1910, Chicago  
Instructor in History and Mathematics; Principal of the Sub-  
Collegiate Department; Director of Women. 1906
- JAMES GREENLEAF BROWN, 89 E. Alameda St.  
Instructor in Botany. 1909
- BERT AUGUSTUS SNOW, M. E. 803 E. Seventh St.  
B. S. 1907, Colorado (Agr.); M. E. 1910, Cornell  
Instructor in Mechanical and Electrical Engineering. 1910
- HOWARD ARCHIBALD HUBBARD, A. M. 109 Olive Road  
A. B. 1904, A. M. 1906, Ohio Wesleyan Univ.  
Instructor in Economics and History. 1912
- ELSA CHAPIN, B. A. 720 E. Third St.  
B. A. 1909, Wellesley  
Instructor in English and in Physical Training. 1912

- ARTHUR LUDWIG ENGER, B. S. 435 E. Third St.  
B. S. 1911, Illinois  
Assistant Engineer, Experiment Station. 1912
- CLIFFORD NORMAN CATLIN, A. M.  
A. B. 1903, A. M. 1912, Nebraska  
Assistant Chemist, Experiment Station. 1912
- RAYMOND LEAMORE QUIGLEY, B. S. E. Fifth and Vine St.  
B. S. 1913, Chicago  
Director of Athletics. 1912
- ANITA CALNEH POST, Ph. B. 832 E. Fifth St.  
Ph. B. 1909, Arizona  
Instructor in Spanish. 1913
- DEROSSETTE THOMAS, B. S. West Cottage  
B. S. 1913, Diploma in Dom. Science 1908; in Domestic Art,  
1914, Columbia  
Instructor in Home Economics. 1913
- JOHANNES CORNELIS THEODORUS UPHOF, 207 E. Third St.  
1906, College of Horticulture, Frederiksvord; 1908, University  
of Amsterdam, in Botany  
Assistant in Plant Breeding, Experiment Station. 1913
- WILLIAM SEATON HENDRY, 903 E. Seventh St.  
Instructor in Mechanical Engineering. 1913
- MABEL AENELLA GUILD. 107 Olive Road  
Assistant Librarian. 1907

## ADMINISTRATIVE OFFICERS

- ARTHUR HERBERT WILDE, Ph. D., President. Campus
- ROBERT HUMPHREY FORBES, M. S., Director of the Experiment  
Station, and of Agricultural Instruction. 105 Olive Road
- CHARLES ROSS STEWART, Business Manager. 1444 E. Third St.
- ANDREW ELLICOTT DOUGLASS, Ph. D., Secretary of the Faculty.  
1189 Speedway
- FRANK CALEB KELTON, B. S., Registrar. 412 E. Fourth St.
- JOHN ELVIN LOGAN, Superintendent of Grounds. Campus
- IDA CHRISTINA REID, Ph. M., Director of Women. Pima Hall
- CORNELIA RICHERT POINDEXTER, Matron West Cottage
- ADA ENGLISH, Office Secretary. The Glenwood

CHARLES EDWARD GRASSICK, Secretary, Experiment Station. 1913  
731 No. First Ave.

ARTHUR WELLINGTON DUNSTAN, Bookkeeper 220 E. Fourteenth St

RUTH ELYN HEAGY, Librarian, Experiment Station. 1913  
220 E. 14th St.

EUNICE WALLER, Stenographer, Experiment Station. The Glenwood

ALICE MARGARITE HECKMAN, Secretary, Bureau of Mines.  
725 E. Fourth St.

## FACULTY COMMITTEES FOR THE YEAR 1913-14.

### COMMITTEE ON REGISTRATION

Professor Kelton, Chairman; Professors Waterbury, Medcraft,  
Willis, Otis, Miss Reid.

### COMMITTEE ON CURRICULUM

Professor Clapp, Chairman; Professors Thornber, Bates, Dines,  
Kelton, Otis.

### COMMITTEE ON STUDENT ENTERPRISES

Professor Bates, Chairman; Professors Guild, Perry, Wilson, Mr.  
Quigley, Miss Reid, Miss Chapin.

### COMMITTEE ON LIBRARY

Miss Lutrell, Chairman; Professors Bates, Vinson, Newsom, Mr.  
J. G. Brown, Mr. Hubbard.

### COMMITTEE ON EXTENSION WORK

The President, Chairman; Professors Turrell, Meserve, Aldrich,  
Newsom, Willis.

### COMMITTEE ON ADMINISTRATION

The President, Chairman; Professor Guild, Vice-Chairman; Pro-  
fessors Forbes, Douglass, Waterbury, G. L. Brown, Turrell, Miss  
Reid.

### COMMITTEE ON ATHLETICS

Mr. Quigley, Chairman; Professors G. L. Brown, Meserve, Kel-  
ton, Mr. J. G. Brown.

## ORGANIZATION

The University of Arizona was established by Act of Legislative Assembly in the year 1885, and opened to students in October, 1891.

The University is an integral part of the system of public education established by and for the State. Its general organization is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of 1901; the government of the institution is vested in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and Superintendent of Public Instruction of the State, ex-officio, and other members appointed by the Governor.

In creating the University, the Legislative Assembly wisely unified under one management the various schools and institutions of higher learning or investigation in Arizona,—the college of liberal arts, the schools of mining and engineering, the agricultural college, and the agricultural experiment station. No professional schools of law, medicine, dentistry, music or education have been established. The University consists of

- I. The College of Liberal Arts, of Agriculture, of Engineering—civil, electrical, mechanical, and mining.
- II. The Agricultural Experiment Station.
- III. The Preparatory or Sub-Collegiate Department.

The Sub-Collegiate Department will gradually disappear as the educational system of the State establishes efficient high schools; the first and second years of this work have already been discontinued.

All department of the University are open to properly qualified persons of both sexes. Through the aid received from the United States and from the State, its privileges are offered to residents and non-residents, at very moderate charges. The number of students in any one class or section of a class is such that each student may receive the individual attention of the instructors.

The purpose of the University of Arizona, in the language of the organic law, is "to provide the inhabitants of this State with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and so far as possible a technical education adapted to the development of the peculiar resources of Arizona. In furtherance of this latter purpose, instruction is provided in



the liberal arts and in subjects fundamental to agriculture and engineering.

The University, by nature of its situation, is a great mining laboratory, some of the mines developed on a large scale being within a few miles of the campus. The University offers exceptional advantages to the students of mining engineering who desire to see the actual operation of great mines, or the development of great enterprises, while carrying on the theoretical and experimental work of the mining course.

The advantages in civil engineering are hardly less noteworthy, for Tucson is not only a division point on the main lines of the Southern Pacific railroad and the El Paso and Southwestern railroad, with shops, roundhouses, and engineering offices, but it has the administrative and engineering headquarters for five of the subsidiary or allied lines of the Southern Pacific system in Arizona and in Mexico, commonly known as the Randolph lines, including the great West Coast Line in Mexico. All of these lines furnish excellent opportunities for observation and vacation employment for students of civil engineering.

The University is also favorably situated for the study of agriculture. Tucson has many irrigated farms in its neighborhood, is near the great range country of southern Arizona, and occupies a central position with relation to the agricultural activities of the State. The University has kept pace with the growing interest and investment in agriculture in the State and has adapted its instruction and research in this science to the special needs of the State.

#### LOCATION AND CLIMATE

The University of Arizona is situated at Tucson, a city of eighteen thousand inhabitants, on the main lines of the Southern Pacific railway, and the El Paso and Southwestern System, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad valley at an elevation of 2,400 feet above sea level and is surrounded by mountains. Its dry, mild, and equable climate has made Tucson a winter resort unsurpassed for healthfulness. Little rain falls during the winter; fogs are all but unknown; cloudy days are rare. The percentage of sunshine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states.

The total amount of rainfall for the year averages less than twelve inches.

These advantages insure to students a comfortable education and a wide range of our-door recreations throughout the college year.

The University Campus, consisting of sixty acres, is situated upon high ground about a mile from the business center of the city with which it is connected by an electric car line. On every side it commands a view of mountain scenery of remarkable extent and grandeur.

An abundant supply of good water for household, laboratory, and irrigation purposes is drawn from a large well on the Campus from a depth of one hundred and twenty feet, thus securing immunity from the dangers of a contaminated water supply. The Campus has a complete sewer system connecting the buildings with the city mains at the University gate. The buildings are lighted by electricity.

The Campus, carefully laid out in drives, lawns, and gardens, with a large number of palms, olive, ash, umbrella, pepper, bagota, and cottonwood trees has the air of a well kept park.

#### MAINTENANCE

The University is maintained by funds appropriated by the United States and by the State of Arizona. Fifty-seven sections of valuable pine land in Coconino county have been set apart by the Federal government for the benefit of the University, a small sum being annually received from the leases of this land.

By the provisions of the Morrill Act of 1890, the University receives annually from the United States the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction." This Morrill Fund is duplicated by the Nelson Fund, created by the Act of March 4, 1907. The University receives from the same source, for the support of the Agricultural Experiment Station, \$15,000 yearly from the Hatch Act of 1887 and \$15,000 additional from the Adams Act of 1906.

The appropriations of the Legislature for the biennium 1913-15 were \$163,500 for maintenance; \$20,000 for general improvements; \$165,000 for a fire-proof agricultural building; \$28,900 for current expenses of the Experiment Station; and \$30,000 for a new experiment farm in Salt River Valley.

The endowment of \$5,000 granted in 1911 by the El Paso and Southwestern Railroad for the use of the Agricultural Experiment Station in carrying on hydrographic work in Sulphur Spring Valley still affords means for continuing these studies, in cooperation with property owners of the Valley.

During the year the Southern Pacific Company has contributed \$2,000 for the work of the Experiment Station in the Sulphur Spring Valley.

The University also receives annually a small amount from miscellaneous sources such as matriculation, tuition, and dormitory fees.

#### ENDOWMENT

By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, the sum of \$10,000, the income from which is to be annually applied for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the department of mineralogy and School of Mines of the University of Arizona. The fund thus created has been named the Douglas Endowment Fund.

#### BUILDINGS

University Hall, the oldest of the University buildings, contains recitation rooms, laboratories and apparatus rooms of various departments, an assembly room, and the office, laboratories and library of the Agricultural Experiment Station.

The Library and Museum building, a handsome structure of red brick and Bedford sandstone, contains the library reading room, a large, well-lighted room, furnished with heavy solid oak reading tables, desks and wall cases; the stack room at the rear, fitted up with modern steel racks; the Museum; a laboratory and a lecture room for the department of geology; work rooms for the library; the offices of the president and business manager of the University.

Science Hall, a new building, of architecture harmonious with the Library, which it faces, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the third to chemistry and biology. The roomy attic and a superstructure on the roof are used as an astronomical observatory.

Pima Hall and West Cottage provide dormitory accommodations for about 40 young women. Each hall has its parlor, living rooms, modern sanitary equipment, and sleeping porches.

South Hall, a large brick building, is a dormitory for college men and for male preparatory students. It accommodates sixty-five students.



Arizona Hall, a new dormitory for forty men, completed in March 1913, is a model of construction, in brick and reinforced concrete; the rooms are unusually large, with commodious closets. A large porch provides sleeping accommodations in the open air for all the residents.

East Cottage is a brick residence, occupied by the department of home economics.

The Dining Hall provides boarding accommodations for all persons living on the Campus.

The Shop and Assay building contains well equipped class-rooms, laboratories, shops, and instrument rooms for various departments of engineering.

The Mill or Mining Machinery building is a plain wooden structure equipped with stamp mills, jigs, concentrating tables, separators, and other machinery necessary for the mining laboratory.

Herring Hall, the gymnasium, 40 x 80 feet in size, is the gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The pump house and mechanical engineering laboratory, built of brick, cement and iron, is practically fire proof, thus insuring safety to the well and pumps supplying the University with water for all its uses.

A two-story brick residence is occupied by the President of the University.

Other buildings are the cottage occupied by the Superintendent of Buildings and Grounds, three greenhouses, a brick carpenter shop, and various smaller outbuildings used for stable, shops and store rooms.

#### THE UNIVERSITY LIBRARY

General Statement—The University library contains 21,000 bound volumes exclusive of public documents, and several thousand unbound bulletins and reports chiefly agricultural.

The present appropriations provide for an annual increase of about 1,500 volumes. Since, of the total accessions nearly one-half has been made within the last five years the books, as a whole, have a direct bearing upon the college work now offered. Of these volumes a collection of complete sets of certain scientific and literary periodicals, to which additions are made yearly, is of special service to those interested in research.

The library is a regular repository of United States documents; these publications have been placed in a separate room where they are arranged by departments. The library has recently added to its catalogue the U. S. card indexes issued by the Department of Agriculture. Much of the early material therein indexed has been received through private donations and the later numbers secured by application, thus making the sets very satisfactory for use in reference work.

**Classification**—The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary card catalogue of authors, subjects and titles in one alphabetical arrangement. Printed cards from the Library of Congress are used, supplemented by typewritten cards for books reported as not in their stock.

**Withdrawal of Books**—All books with the exception of periodicals and books reserved for reference may be drawn for home use by all persons connected with the University and the use of the library for reference purposes is extended to the general public as well. The Library is open 12 hours on week days during the academic year, with the exception of Fridays and Saturdays, when a somewhat shorter schedule is observed.

**Correspondence and Loans**—Reference work for teachers and students throughout the state is gladly undertaken by correspondence. Loans of books will also be made to teachers and others engaged in systematic study in so far as the grant is not precluded by the need of the material at the University.

The Library subscribes for some 200 periodicals and papers for use in the Reading Room. This room is also supplied with about 600 reference books,—encyclopedias, dictionaries, periodical guides, etc., which may be consulted by the students without formality.

The librarian offers a general course in the use of books, elementary bibliography, and library administration, open to all students (see under "Bibliography").

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## MUSEUM

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The collections now displayed at the University comprise representative series of minerals, ores and rocks of Arizona, noteworthy among these being superb specimens from the mines of the Copper Queen Mining Company at Bisbee. There are also collections of typical rocks and materials for comparison, and many specimens of ores from different parts of the United States and from abroad. It

is desired to make the collection of ores and minerals fully represent the great mineral resources of Arizona.

The Museum is indebted to the late Mr. Herbert Brown, for a large and valuable collection of skins of the birds of Arizona; for a collection of ancient aboriginal pottery and other relics; the fossil skull and teeth of an elephant, and other fragmentary remains of extinct animals, sent from Yuma.

The Museum has been made the custodian of a collection of arms and military relics, chiefly from the Philippine Islands, deposited by Captain Charles C. Smith, of Fort Huachuca, Arizona.

Historical records of much value are gradually accumulating as a part of this museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and this history. All records and data of any nature that can be gleaned are worthy of preservation, and it is earnestly desired to have them placed at the University, where they will always be accessible for reference.

#### AGRICULTURE AND HORTICULTURE

The University demonstration farm consists of eighty acres of Rillito Valley land. Much of the land has been cleared and seeded to alfalfa. Space is provided for various crops and for fruits. The irrigation system includes an excellent well with a number five Krogh pump operated by a distillate engine. The distributing ditch is of cement tile.

Residences are provided for the farm foreman and his family and for the workmen. A machinery shed with workroom has been recently constructed. A horse barn, a dairy barn, a 6000-gallon water tank, a dairy herd of pure bred animals, a dairy house with all appliances are other parts of the farm equipment.

The agronomy laboratory is equipped with apparatus for teaching soil physics; green houses furnish accommodations for laboratory work in plant culture and other horticultural subjects.

The agricultural section of the University library contains leading reference works in agriculture, including cyclopaedias, herd books, standard texts, and experiment station bulletins. The student is required to make much use of this material.

The laboratories of the Agricultural Experiment Station and its plant breeding and plant introduction gardens, located on the University campus, enable one to observe the working out of problems of vital interest to the agriculture of the State. The campus itself, with

its many ornamental trees, shrubs, and flowers, all of which are peculiarly adapted to the climate of the arid Southwest, furnishes excellent facilities for the study of ornamentation.

"Timely Hints for Farmers," issued by the Experiment Station, are of distinct educational value. Several thousand farmers of the State are reached more or less regularly by publications on subjects of vital interest. Farmers' Institutes are supplemented by short courses in agriculture. A Demonstration Train has been operated in the current year by the University in cooperation with the Santa Fe, Southern Pacific, Arizona Eastern, and El Paso and Southwestern lines.

Small and well selected agricultural libraries of small cost have been forwarded to a considerable number who have expressed a willingness to receive them.

#### ASTRONOMY

The atmosphere of southern Arizona is perhaps the best in the United States for astronomical observation, having smaller percentage of cloud and less average wind velocity than any other locality where records have been preserved. The dry air and 2400 feet elevation give Tucson so clear a sky that faint stars may be watched till they set; the fine weather, day after day, gives opportunity for consecutiveness of observation not obtainable elsewhere; a greater portion of the year is available, with little interference from air currents.

The course in astronomy draws attention to these advantages, and, also gives that understanding of the motions of the earth and planets which is important in many branches of engineering. The eight-inch Harvard telescope with its Clark glass and the four and one-fourth inch Brashear telescope of the University are always available for closer study of the heavenly bodies. Two excellent clocks with electric connections for transmitting time permit longitude, latitude and time observations.

#### BIOLOGY

The biological laboratories occupy a convenient and well lighted suite of eight rooms, and have equipment suited to modern instruction and research in the biological sciences, to the region and to the courses offered.

The herbarium consists of 50,000 mounted specimens, of which 20,000 sheets are in the Arizona botanical survey collection. There are also 6,000 sheets in the herbarium of cultivated plants. The building up of these collections is progressing rapidly, largely by virtue

of the work on the botanical survey of the State, which is being conducted by the department of biology, and which will result ultimately in the publication of a Flora of Arizona. The unique flora and fauna of the mountains, foothills, mesa and river valley collecting grounds, in close proximity to the institution, offer attractive opportunities for instruction and research, particularly along taxonomic and ecological lines.

There are articulate and inarticulate skeletons, plaster and papier mache models of the more important structures of the human anatomy, and duplicate material for study and dissection. The department has 28 compound microscopes of the latest Spencer, Bausch and Lomb, and Leitz types, which number is being added to each year. About \$600 has been invested in new plant physiology apparatus.

The Desert Botanical Laboratory of the Carnegie Institution supplements in admirable manner the facilities of the University for botanical investigation, particularly as concerns field plant physiology and plant geography.

#### CHEMISTRY

The chemical equipment used for instruction occupies twelve laboratories, class rooms, and storerooms, on the second and third floors of Science Hall.

The laboratory used by Freshmen for the study of general chemistry and qualitative analysis is newly furnished throughout with desks, hoods, and racks. It accommodates forty-eight students.

The laboratory for quantitative analysis is equipped for the teaching of volumetric and gasometric analysis, and metallurgical chemistry, including apparatus for the electrolytic determination of metals. The balance room contains analytical balances of the latest models so arranged as to insure a maximum of stability and accuracy.

A lecture and demonstration room fitted with sinks and cabinets completes an equipment of apparatus and collections adequate for comprehensive instruction in both theoretical and practical chemistry.

The laboratory of physical chemistry has the following apparatus: Wanner's Optical pyrometer, the Chateliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, Abbe refractometer, large wave length spectroscope made by Adam Hilger, thermostats, polariscope, and apparatus for conductivity work and the determination of electro-motive force.

A small laboratory is equipped for electroanalysis, and another for organic chemistry and gas analysis.



The laboratories of the Agricultural Experiment Station are devoted to analytical work and to chemical investigations relating to agriculture. Though not intended for the use of students, they are of incidental value to the instructors and students through the investigations conducted.

#### CIVIL ENGINEERING

The present quarters of this department are a recitation room, an instrument room and office, a materials testing laboratory, and a drafting room.

The surveying instruments include six transits, four levels, two plane tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used in engineering construction. The apparatus includes an Olsen 100,000 pound universal testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, a moist chamber and other auxiliary equipment.

#### GEOLOGY

The department of geology occupies two rooms in the Library building, one a lecture and drawing room, and the other a laboratory containing drawers for rock and ore specimens. The laboratory possesses a set of the geological folios and topographical maps published by the United States Geological Survey, and a series of rocks and ores supplemented by the collection in the Museum. The equipment further includes a Nachet polarizing microscope, a Leitz metallographic outfit for the study of polished surfaces of ores; a complete outfit for field work, with transit, plane tables, and alidades, as well as barometers, pocket transits, telometer, and pocket levels. The equipment of this laboratory is supplemented by that of Mineralogy and Petrography, and that of Mining and Metallurgy.

#### MECHANIC ARTS

The Shops and Drawing Room include a large shop and machinery room, with adjacent tool, supply, and store rooms; draughting, model, pattern, and lecture rooms, and office. The entire building is well ventilated and lighted from above as well as from the sides.

The wood shop has a full assortment of hand tools, twenty-four benches with a complete set of tools for each, six turning lathes,

Beach scroll saw, a Whitney dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a combination shear and punch, a blacksmith's drill press, and a full assortment of small tools and appliances. Blast is furnished by a No. 3 Sturtevant blower; smoke and gases are removed by a 70-inch exhaust fan.

The machine shop contains one 24-inch and two 14-inch Lodge and Shipley engine lathes, a 14-inch Pratt and Whitney lathe with taper attachment, a 12-inch Seneca Falls lathe with taper attachment, draw-in chuck, and English and Metric change gears; a 10-inch Reed speed lathe, a 16-inch Cincinnati shaper, a 24-inch by 6-foot Woodward and Powel planer, a Browne & Sharpe No. 2 Universal milling machine, a Browne & Sharpe No. 1 Universal grinder, a Prentice 24-inch drill press, a 13-inch Slate sensitive drill, a power hack saw, a drill grinder, an emery stand, a grinding attachment for lathes, 1½ ton portable hoist, a 1-ton triplex hoist, ½-ton screw hoist. Each shop has its own tool room with small tools, gauges, and measuring instruments.

#### MECHANICAL AND ELECTRICAL ENGINEERING

The department possesses a comprehensive catalogue file containing the trade literature of about five hundred leading manufacturers of this country, together with a large collection of working drawings, and sample collection of models, machine parts, valves, electrical fittings, insulating materials, and abrasives.

The laboratory is equipped for experimental work in the study and operation of steam boilers, steam and gas engines, hydraulic and electrical machinery. Besides the machinery of the shop and mill which may be used for the study of machine design as well as for experimental work, the University has a 75-horsepower internal furnace marine type boiler, 45 horsepower return tubular boiler, a 5 horsepower vertical experimental boiler, a 35 horsepower Atlas center crank engine, a 60 horsepower Fort Wayne high speed automatic side crank engine, direct connected to 50 k. w. generator, a 30 horsepower Fort Scott engine, a 10 x 7 x 10 Worthington duplex direct-acting steam pump, a small duplex pump, a small Cameron boiler feed pump, an injector, a 40 horsepower Fairbanks Morse gasoline engine direct connected to a 500 gallon high pressure fire pump, a 23 k. w. Crocker Wheeler direct current generator, a 5 k. w. Fort Wayne rotary convertor, a 15 horsepower Wagner variable-speed induction motor, a 7 horsepower Westinghouse induction

motor, a 7 k. w. Westinghouse direct-current generator, direct connected to a four-cylinder gasoline engine, a 3 horsepower and a  $\frac{1}{2}$  horsepower direct-current motor, a 5 k. w. Packard variable voltage transformer, two small testing transformers, and, for measuring instruments, two graphic recording volt meters and ammeters, several integrating watt-meters, and a series of indicating meters. An 8" x 10" triplex pump with its electric motor serves as part of the equipment of the laboratory, and furnishes the University with its water supply. The department is equipped with steam indicators, gauges, and weighing scales. For the testing of pumping machinery a large steel box overflowing into cement cistern is connected by suitable piping to the various pumps in the laboratory.

#### METALLURGY

The Mill or metallurgical laboratory tests the adaptability of ores for treatment by different processes both on a large and small scale.

The chief features of the equipment are a Blake crusher, 4 in. by 7 in.; a Dodge crusher, 4 in. by 6 in.; sampling rolls, 6 in. by 9 in.; a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lightning crusher and a disc pulverizer; a 5-stamp mill, with 800-pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamation plates for the same; a 2-ft. clean-up pan; a 1-ft. amalgamation pan, and a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table of the latest pattern, and a Hallett hand jig; a  $1\frac{1}{2}$  ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; 3-ft. agitator; a 12-in., 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturtevant shaking screen; a Tullock ore feeder; a belt and bucket elevator, sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

The power for operating this plant is furnished by a 30 h. p. Westinghouse induction motor, type C.

The Callow Miniature Plant has been recently added, consisting of: A small two-compartment Harz jig, a small Wilfley table, a canvas slime table, an amalgamating plate, a set of hydraulic classifiers, a set of cyanide agitators, an automatic feeder. This plant is driven by a  $\frac{1}{8}$  h. p. motor and stands on a hopper bottom tank divided into three compartments. It is a complete ore dressing plant, gold mill—and together with the cyanide percolators described elsewhere



—cyanide mill, and tests quantities of ore ranging in amounts from 25 to 400 pounds. The results from these tests should predict the performance of a full size plant. There are also a Richards' pulsator jig, a Richards' pulsator classifier, and an International dry concentrator.

In the assay laboratory there are assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam, fired with coke, gasoline, and gas, so the student becomes trained in the use of all these fuels; all needed appliances for assaying by dry and wet methods including electrolysis; desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores, in mineral fertilizers, and in qualitative tests of minerals.

#### MINERALOGY AND PETROGRAPHY

There are two laboratories for mineralogy, one being used for microscopic work in petrography and the other for blowpipe analysis and determinative mineralogy. The laboratory for microscopic work contains seven petrographic microscopes including both American and foreign make, Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin section corresponding, 120 oriented sections of minerals, and apparatus for photomicrography and projection. The laboratory for blowpipe analysis is supplied with minerals for making the necessary tests and studying the physical properties. A type set of 600 minerals classified according to Dana is included. For the study of crystallography, there are a collection of 300 pasteboard models of crystals, numerous glass and wooden models, two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer of the most recent type, apparatus for projection and drawing of crystals, and a model machine for cutting crystals from plaster of Paris.

#### MINING ENGINEERING

The laboratory for the practical study of mining engineering is attached to the mill building. To the rear of the mill a mine in actual operation permits a study of all the problems of mining, such as sinking, drifting, timbering, stoping, drilling, blasting and the various other processes.

The equipment of the mining laboratory includes an assortment of hand and machine tools, and all apparatus for testing purposes; a WG3 8 x 8 Sullivan belt driven compressor, with 30 x 6 pressure

tank; a FF12 Sullivan 2½ Lite Weight drill with tripod; a DC19 jack hammer drill, Sullivan type; a Waugh drifting drill; a Chicago stoper; a 40G Cleveland stoper; a No. 1 Model V. Murphy block hole drill; a 2½" Pacific rock drill, with clamp and column; a 3" Leyner Model 5 slugger, with tripod; a Flottman hammer with clamps and columns; a 4E Temple Ingersoll electric air drill, with clamp and column; a Rogers 3" rock drill, with tripod; a 12A Waugh stoper; a 2½" Wood drill, with clamp and column; a McKiernan Terry jack hammer drill; a large assortment of hose of various kinds and makes, and steel; lighting devices and miners' lamps, candle sticks, acetylene lamps, electric mine lamps; a double inlet Sirroco fan, a model Connellsville involute blower, a 3½" Acme blower and a 12" Typhoon blower.

Pumping and drainage are effected by a 6 x 24 Frenier sand pump, a Cameron model pump, a 4" type EE American centrifugal pump, a 5½ x 2½ x 3 Blake pump; 1" Class O Buffalo centrifugal pump; a model Connellsville cycloidal pump; a 3 x 2 x 3 Dow steam pump; a 1" Dow centrifugal pump; a 3 x 2 x 4 Dean Bros. steam pump; an Edison 8 ft. trench pump; a type N Kingsford centrifugal pump; a 2" Krogh vertical centrifugal pump; and a 5¼ x 3½ x 5 Worthington steam pump.

The sharpening department is equipped with a Buffalo forge, with a No. 3 Leyner oil forge, with anvil and complete assortment of tools.

The timbering framing department is equipped with tools, and with a large number of models showing the construction of underground timber, as well as head frames, ore bins etc., above ground. The mine is to use Kilbourne & Jacobs' ore cars.

#### PHYSICS AND ASTRONOMY

The department of physics has facilities for the demonstration of important phenomena. A lecture room seating forty persons is fitted with lights, water, gas, heliostat, alternating and direct currents of great range, an opaque projection lantern, elevated seats, and shutters for darkening the room. Two large main laboratory rooms supply space for mechanical and electrical work, while special rooms are devoted to heat, sound, light, magnetism and research work. A carpenter's shop, a repair and store room, a photographic dark and enlarging room, and a constant temperature room are provided. A pendulum seismograph is installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. There are also a large Oudin resonator and a mercury interrupter, manufactured by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Hon. Mark J. Egan, of Clifton, the University has a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. The department possesses also a Knott wireless outfit of  $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles; three motor generator sets, the largest having an output of 7-kilowatts; a Leeds and Northrup potentiometer and accessories; and very complete apparatus for showing electro-magnetic phenomena, rotary fields, and stationary electric waves.

For astronomy an 8-inch Clark lens and mounting, both of the finest quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are erected on a cement pier supported on the main walls of the building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, sidereal and mean time clocks, and pier for latitude and longitude observation.

#### HOME ECONOMICS

East Cottage has been remodeled for the department of Home Economics. Its two large laboratories—one for sewing and the other for cooking—are equipped for individual rather than group work.

The model dining room is attractively furnished. A demonstration cookery laboratory will be fitted up, where students give lectures to their classmates, an invaluable experience preparing young women to teach or to be of assistance in their clubs or homes. A model bed room is also to be provided, and here the practical work of the home nursing course is to be given.

#### GYMNASIUM

Herring Hall, the gymnasium, is well supplied with standard apparatus such as chestweights, dumb-bells, barbells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jumping and vaulting stands, fencing foils and masks, basket balls and goals, five large mats and a set of anthropometric apparatus.

In the basement are one hundred and forty-four lockers, and five shower baths supplied with hot water from a heater with large reservoir.

The outdoor equipment consists of two baseball fields; a football field, six-lap track, and straightaway; five tennis courts; and a basketball court for girls.

#### MILITARY

An armory is fitted with the necessary gun racks and accessories. The equipment includes 100 Krag cadet rifles with complete accoutrements, 4 model 1906 Springfield chambered for .22 for indoor practice, 12 sabres and belts, musical instruments for the band, signal flags, and targets for short range practice.

Annual encampment is held at Phoenix during the State Fair, tentage being furnished by the State. The mess outfit is provided by the University and the meals of cadets while in camp are under the direction of the University Quartermaster.

#### DISCIPLINE

The disciplinary policy of the University in all its departments is based upon the assumption that students come to the institution with a determination to utilize the opportunities offered, and with a keen sense of duty, honor and courtesy to each other and to the faculty.

Students or classes desiring to make requests of the faculty should file their petition in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.

#### LIVING ACCOMMODATIONS

Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, accommodating about sixty-five students, two in a room; in Arizona Hall (for College men only), accommodating forty students; Pima Hall and West Cottage provide accommodations for forty young women, under the direction of a capable and experienced preceptress.

All dormitories are lighted by electricity. Rooms contain a clothes press, single bedstead, tables, chairs, mirror, wash bowl, and pitcher. Students will supply their own mattresses, pillows, sheets, blankets, towels, rugs, and brooms, laundry bags, and such other articles as they may desire for ornamenting their rooms. They will care for their own rooms under the direction of the head of each dormitory.



The Dining Hall of the University is under the management of a paid steward who is responsible to the President and the Board of Regents. It is the aim of the University to serve substantial, wholesome, appetizing meals at cost. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside of the dormitories may board at the Dining Hall.

Board is payable in advance on the twelfth of each month. If payment is not made before the fifteenth of each month, \$21.00 instead of \$20.00 will be charged for the month's board. Checks and post-office or express money orders should be made payable to the University of Arizona.

## FEES AND EXPENSES

	LOW	HIGH
Tuition free to students from Arizona.....		
Tuition, students non-residents of Arizona, each semester .....	\$15.00	\$15.00
Incidental fee, paid annually.....	10.00	10.00
Mining excursions for advanced students.....	20.00	40.00
Military uniforms.....	21.00	21.00
Books, a year.....	10.00	25.00
Board, a month.....	20.00	20.00
Dormitory fee, annual.....	25.00	25.00

## LABORATORY FEES

Assaying. See Metallurgy 2.	
Astronomy 3.....	\$ 1.00
Botany, 1, 2, 3, 4, each.....	2.50
Chemistry 1, 2, 3, 4, 5, 6, 7, each when taken as 4 units.....	12.00
Chemistry 9, 10 each.....	5.00
Chemistry 21, 22, each.....	6.00
Civil Engineering 3, 11, 13, 14a, 15, 17, 18, 20, 22, each.....	.50
Civil Engineering 1, 2, 6, 7, 8, 9, 10, 14b, 19.....	1.00
Civil Engineering 14.....	1.50
Geology 5, 6 (year).....	10.00
Home Economics, cooking, each course, a semester.....	5.00
Home Economics, sewing, each course, a semester.....	2.00
Mechanic Arts I, II, 1, 2 (each year).....	1.00
Mechanic Arts—Shop courses each semester unit.....	1.50
Mechanical and Electrical Engineering, drawing, a year.....	1.00
Mechanical and Electrical Engineering, laboratory, semester....	3.00
Metallurgy 2, (Assaying).....	15.00

Metallurgy 5a, 5b, 6, each.....	10.00
Mineralogy 1.....	12.00
Mineralogy 5, 6 (year).....	5.00
Mining laboratory, a semester.....	5.00
Physics 1, 2, IV, each semester.....	1.00
Physics 3, 4, 5, each semester.....	1.00

Should the total of the registration and laboratory fees of a student whose residence is in Arizona exceed \$50 in a given year, the amount in excess of \$50 will be rebated to him.

Members of the cadet companies will be required to provide themselves with the prescribed uniforms which will be ordered by the University. The Uniforms have shown better wearing qualities than a civilian suit of equal cost. The total expense of both uniforms is about \$20.00.

The cotton olive drab khaki is worn in the warmer season, woollen olive drab in cooler weather.

Cadets will also pay the cost of their transportation to the annual encampment, amounting to about \$5.00. Students who are members of the cadet companies and do not live on the campus are charged \$4.00 for their board during the period of encampment.

Text-books may be obtained through a campus book store managed under the direction of the University.

#### REBATES

The following is the system of rebates followed if a student is compelled for any reason to leave the University, the general intention being to charge the student only for the privileges actually used.

On the Registration Fee of \$5.00 included in the Incidental Fee (\$10.00), a rebate pro rata for the remainder of the semester or year.

On the Student Activities Fee of \$5.00, which is included in the Incidental Fee, *no* rebate, the full amount paid having been credited to the Student Activities Fund and having been distributed to the individual enterprises.

On Laboratory Fees, when such fees are a flat rate for wear on apparatus, a rebate pro rata for the remainder of the period for which payment has been made; when such fees are based on consumption of material, a rebate of the balance between the amount paid and the value of the materials consumed.

On rent of room in a dormitory, a rebate pro rata.

On board in the Dining Hall, when the absence amounts to three consecutive days or more, and if previous notice has been given to the manager of the hall, a rebate pro rata.

#### ASSISTANCE TO STUDENTS

Various positions about the grounds, buildings and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting. The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, able to do this outside work and at the same time maintain a good record as students.

The Students' Loan Fund gives temporary assistance to deserving students, men or women. The conditions under which loans are made may be ascertained on inquiry of the President of the University.

*County Scholarships*—By act of the legislature a scholarship in the University is granted to each county of the state, to be assigned to that student who passes the best examination set by the University. The examination is under the supervision of the County School Superintendent and is held in the month of June. The papers are read at the University, the President certifies the results to the County Superintendent and to the successful candidate.

Candidates for county scholarships are examined upon the following subjects: English, algebra, science (either agriculture, botany, zoology, physics, chemistry, or physical geography); and two other subjects (chosen from history, Latin, French, German, Spanish, or a second science). The examination is restricted to five subjects.

The scholarship amounts to \$150 a year and is payable by the State direct to the University, to be applied on the student's bills for board, room, incidental, and other fees. (The full amount of these fees may be found by referring to the index of this volume under "Expenses".)

The scholarship is good for one year at the University and is to be held during the student's Freshman year, except that when a given county offers no candidate for the Freshman class, a candidate for admission to a higher class in the institution may apply for the qualifying examination and if successful, secure the scholarship.

*The Bennett Scholarship*—The Philo Sherman Bennett scholarship is endowed by the gift of \$500 to the University in 1905, through the agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

## REQUIREMENTS FOR ADMISSION

Applicants for admission to any department of the University are required to furnish satisfactory evidence of good character, and certificate of graduation or of honorable dismissal from the schools last attended.

For admission to the Freshman class applicants must be at least sixteen years of age and must satisfy requirements in subjects sufficient to give fifteen credits as described below. A credit is understood to be the equivalent of one study pursued satisfactorily five times a week for one year, as ordinarily taught in an approved high school. Students coming from approved high schools and preparatory schools, and presenting from the principals of such schools a detailed official statement of work completed, will be excused from entrance examination in those subjects. Other students will be required to pass the entrance examinations.

For admission to the course leading to the degree of Bachelor of Arts or Bachelor of Science, the subjects and credits assigned each are:

English .....	3	Physics, Chemistry or Bi-	
Algebra .....	1½	ology .....	1
Plane Geometry.....	1	Latin, Greek, French, Ger-	
History and Civics.....	1	man or Spanish.....	2
		Elective .....	5½

For admission to the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, Civil Engineering, or Mechanical Engineering, the subjects and credits assigned each are:

English .....	3	Latin, French, German or	
Algebra .....	1½	Spanish .....	2
Plane Geometry.....	1	Physics .....	1
Solid Geometry.....	½	Elective .....	6

For entrance to the course in Mining Engineering and Metallurgy applicants must have both Physics and Chemistry. This allows, therefore, but 5 elective units for such students.

A student having a credit in Trigonometry not used for entrance, may waive a requirement of three units in college mathematics upon passing a satisfactory examination in that subject.

For admission to the four year course in Agriculture one may substitute two elective units for the two years of foreign language.



## SCOPE OF THE ADMISSION REQUIREMENTS

## ENGLISH

*English*—3 credits. (a) English classics. An acquaintance with the works named below is required. These works are divided into two classes, those intended for thorough study and those intended for general reading. Preparation in the former class should cover subject matter, form and structure, and the leading facts in those periods of English literary history to which the prescribed books belong. In the latter class, the student should secure general knowledge of the subject matter, and of the lives of the authors. In exceptional cases an equivalent amount of reading and study in other than the prescribed works will be accepted as a substitute. (b) English Composition. The candidate should have the ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs.

No student will be admitted without examination, except on the certificate from his former instructors that the entire requirement has been fulfilled. Substantial equivalents, properly certified, will be accepted.

For thorough study, for 1914. Shakespeare's *Macbeth*, Milton's *Comus*, *L'Allegro* and *Il Penseroso*; Burke's *Speech on Conciliation with America*, or Washington's *Farewell Address* and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-IV of College Entrance Requirements in English for 1913-1914.

## MATHEMATICS

*Algebra*—1½ credits. The work required in Algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportions, etc., as given in standard texts, such as Hawkes, Luby and Touton, Complete School Algebra or Slaught and Lennes.

*Plane Geometry*—1 credit for a year of work. The requirement is based upon the work outlined in text books such as Wentworth and Smith's Geometry, with special reference to original exercises and notebook work.

*Solid Geometry*—½ credit for a half year of work. Original exercises and notebook work are required.

## HISTORY

To meet the requirement in History the student will use, in preparation for each credit, a good textbook, do regular reference work, and keep a notebook with outlines, summaries, maps, and topical notes on readings, varying according to the advancement of the course.

*Ancient History*—to the year 800 A. D. 1 credit.

*Mediaeval and Modern History of Europe*—1 credit.

*History of England*—1 credit.

*History and Government of the United States*—1 credit.

## LANGUAGES

\**Greek*—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

\**Latin*—2, 3 or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; sight reading; *Caesar*, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero and Gellius; Daniell's or Bennett's *Prose Composition*.

\**German*—2 credits. First year: Bacon, *German Grammar*; Storm, *Immensee*; von Hillern, *Hoher als die Kirche*; other readings. Second year: German Composition; Meyer-Foerster, *Karl Heinrich*; Heine, Poems and *Die Harzreise*; Lessing, *Minna von Barnhelm*; Schiller, *Wilhelm Tell*.

\**French*—2 credits. First year: Frazer and Squair, *French Grammar* (Part I); Aldrich and Foster, *French Reader*; Labiche and Martin, *La Poudre aux yeux*; Halevy, *L'Abbé Constantin*. Second year: *Grammar* (Part II); Merimée, *Colomba*; Lamartine, *Graziella*; Sand, *La Mare au Diable*; Canfield, *French Lyrics*; Victor Hugo, *Les Misérables* (abridged).

\**Spanish*—2 credits. First year: Coester, *Spanish Grammar*; Worman, *First Spanish Book*; Turrell, *Spanish Reader*. Second year: Johnson, *Cuentos modernos*; Alarcon, *El Capitan veneno*; Galdos, *Marianela*; Valdes, *La Alegria del Capitan Ribot*; Umphrey, *Spanish Composition*.

\*The courses offered should include the texts outlined, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.

## SCIENCE

*Physical Geography*—1 credit or  $\frac{1}{2}$  credit. A year or half-year of work should include the principles of the subject, as treated in the best recent textbooks, field and laboratory study, and the interpretation and steady use of topographic and weather maps and charts. This subject may be combined in half-credits with physiology, which may in its turn be offered as a full credit if it is so desired.

*Botany*—1 credit or  $\frac{1}{2}$  credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work. Botany as a half-credit may be combined with a half-credit in zoology for a full credit or year's work in biology.

*Chemistry*—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, should include the more common metals and non-metals and their compounds. A careful record of laboratory experiments should be kept.

*Physics*—1 credit. Along with the use of one of the standard textbooks the year's course should include continuous and systematic laboratory practice, recorded in a notebook.

## ELECTIVES

The electives offered for admission should be chosen from the above subjects or any other subjects ordinarily taught in high schools and accepted by colleges and universities of standing.

## ADMISSION TO ADVANCED STANDING

Students coming from other institutions of recognized standing are admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited in the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

## ADMISSION FROM ARIZONA NORMAL SCHOOLS

Graduates of the 2-year and 5-year courses in the Tempe and Flagstaff Normal Schools are given a total credit of 32 units in the University, which shall include the cancelling of the requirements in Philosophy, but shall not cancel the requirements in English 1, 2, nor

any entrance requirement, the equivalent of which shall not have been fulfilled.

#### ADMISSION UPON CERTIFICATE

Since the statutes of Arizona provide that the course of study in the high schools of the State "shall be such as, when completed, shall prepare its students for admission into the State University," the University admits without examination graduates of approved high schools of Arizona. Diplomas or corresponding credentials from high schools and preparatory schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials.

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### COURSE OF STUDY AND DEGREES

All facilities and privileges of the University are open to qualified persons of both sexes.

The courses offered in the University provide both a liberal training along literary and scientific lines and technical training along chemical, engineering, mechanical and agricultural lines. Great latitude of election is given in the literary and scientific courses, but the technical courses are more rigid in their requirements. Full details of the various courses follow. The aim in all is to combine practical with theoretical instruction. The needs of a young and growing commonwealth are kept in mind, and attempt is made to develop the adaptability and resourcefulness necessary to meet changing conditions.

The University offers four-year courses of study leading to the degrees of Bachelor of Arts and Bachelor of Science, and to other specialized degrees as shown hereafter. A full program requires the student to take not less than fifteen hours of class work a week; he will not be permitted to take more than eighteen hours, except on petition granted by the Faculty. In laboratory work a period of from two to three hours is considered the equivalent of one recitation or lecture hour.

#### REGISTRATION

All students are expected to register on registration days at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated for the purpose. Before making choice of elective subjects the student should in every case confer with the instructors concerned and with the Registrar. All students are required to pay an incidental fee at the time of registration, and no student will be considered registered and en-

titled to attend classes unless this fee has been paid. After registration no change in classes may be made without the consent of the President or the Registrar.

After the first week of the student's attendance upon the University, his registration will be regarded as fixed and requests for change will be granted only under unusual circumstances.

Petitions for permission to take more than 18 units of work will not be accepted from students just entering upon their first semester in the University.

Ordinarily students are expected to continue into the second semester the courses taken in the first. A registration day is set at the end of the first semester for such revision of work in the second semester as may be advisable.

Students entering from other institutions should present to the Registrar certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal, and a copy of the school catalogue or course of study in order to facilitate registration.

Students over 21 years of age, or those who have clearly defined needs which are not served to the best advantage by any of the regular courses, may be admitted as special students. A student cannot become a special student merely for the purpose of avoiding some college requirement. Before a student may be classified as a special student he must: First, present to the Registrar, President or Committee on Registration a written statement giving reason for his wishing to take a special course; second, if a minor, must present the written consent of the parent or guardian. A student who has been accepted as a special student may elect any course offered, subject to the approval of the head of the department.

It is expected that those who desire thus to specialize in mineralogy, assaying, geology or surveying, will have had at least a high school education, or its equivalent, particularly in English, algebra, geometry, physics and chemistry.

For the greater safety of the University community the Board of Regents has adopted a regulation that a student at the time of his registration shall submit a statement, signed by a reputable physician, certifying to good health or to such disability as will in any way affect the student's University work or his membership in the University. This requirement pertains to all new students.

The faculty reserves the right to cancel any class when a suitable number of students fails to register for it.



Students who complete satisfactorily the required work, and the specified amount of elective work, as shown in the accompanying schedules, will be given the degree of Bachelor of Arts or Bachelor of Science. The special character of any course of study is indicated by adding to the degree the name of the department, as Bachelor of Science in Mining Engineering.

Military drill (tactics) is required of all male students throughout the preparatory course and during four full semesters of college work.

Physical training is required for both young men and women throughout the preparatory course and for the freshman and sophomore years of college work.

Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units or credits. A unit ordinarily represents one class-room hour a week, or its equivalent of two or three laboratory hours, for one semester. One hundred and thirty-three units including four units in military tactics and one unit in physical culture, are required for the degree of Bachelor of Arts or Bachelor of Science. The requirements for degrees in the specialized courses are given below.

Any candidate for a degree may present as part fulfillment of requirements for graduation an acceptable thesis embodying the result of a special study of some subject within the range of the course pursued. The subject and the credit value of the thesis are to be submitted for the approval of the faculty at the opening of the senior year, and the completed thesis must be presented not later than three weeks before Commencement Day.

#### GROUPS OF SUBJECTS

GENERAL: English, Philosophy, Mathematics, Military Science, Physical Training.

GROUP A: Latin, Greek, French, German, Spanish.

GROUP B: Economics, History, Law, Sociology.

GROUP C: Agriculture, Astronomy, Botany, Chemistry, Geology, Mineralogy, Physics, Zoology.

GROUP D: Home Economics, Civil Engineering, Electrical Engineering, Mechanic Arts, Mechanical Engineering, Mining Engineering and Metallurgy.

#### REQUIREMENTS FOR DEGREES

The Units necessary for the A. B. and B. S. degrees are set forth in the following statement:



Bachelor of Arts	Units
English, including 1, 2, 3, 4, 5, 6.....	16
Foreign language.....	16
Science (Group C).....	8
Social Science or Economics .....	8
History .....	6
Philosophy .....	6
Military Tactics.....	4
Physical Training.....	1
Major Subject, including required courses ...	30-40
Free Electives to make total of 133 units.	
Bachelor of Science	Units
English, including 1, 2.....	10
Mathematics .....	8
Modern Language.....	16
Science (Group C).....	16
Social Science and Economics.....	6
Military Tactics.....	4
Physical Training.....	1
Major Subject, including required courses .....	30-40
Free Electives to make total of 133 units.	

The following subjects may be grouped together for the purpose of making a "Major", in candidacy for the degree mentioned. Not more than 60 units may be taken in one department.

English language, literature; Bibliography. ....	A. B. or B. S.
Romance and Germanic Languages,.....	A. B. or B. S.
Classical Languages, Philosophy, and Art,.....	A. B.
Mathematics and Astronomy,.....	A. B. or B. S.
History and Economics.....	A. B. or B. S.
Physics and Astronomy.....	B. S.
Geology and Mineralogy,.....	B. S.
Chemistry, .....	B. S.
Biology, .....	B. S.
All technical courses,.....	B. S.

### Course Leading to the Degree of Bachelor of Science in Agriculture.

Subjects required of all students in this course, with assigned units.

English 1, 2.....	6	Agriculture 2 or 26.....	3
Mathematics 1a, 1b.....	6	" 3.....	3
Military Tactics.....	4	" 6 or 17.....	3
Physical Training.....	1	" 9.....	4
Mechanic Arts 1.....	2	" 10.....	4
Chemistry 21, 22.....	8	" 18.....	4
Physics 1, 2.....	8	" 24.....	2
Botany 1, 3.....	8		
Economics 1, 2.....	6		24
		Free Electives.....	31
	49	- - - - -	49

Group electives from which a major of not less than 16 units shall be in one group—with 14 other units..... 30

Total of required units.....134

## GROUP ELECTIVES

- Group I, Agronomy. Agriculture 1, 5, 7, 23; Chemistry 1, 2, 3, 4.  
 Group II, Horticulture. Agriculture 1, 5, 13, 14, 19, 20; Botany 14.  
 Group III, Animal Husbandry. Agriculture 4, 11, 12, 15, 16, 21, 22, 25; Botany 10.  
 Group IV, Agricultural Chemistry. Chemistry 1, 2, 3, 4, 7, 8, 9, 10; Food Chemistry.  
 Group V, Biology. Botany 2, 4, 5, 10, 11, 12, 13; Bacteriology; (Entomology); Zoology 1, 2, 3, 4, 5.  
 Group VI, Rural Engineering. Students electing a major in this group should take Mathematics 2, 3, 4, 5, as free electives; Mechanic Arts 8, 9, 11; Mechanical Engineering 1, 2, 3, 4, 12, 14; Civil Engineering 1, 2, 6, 11, 13, 14a, 14b, 15, 19, 20, 22; Electrical Engineering 1, 9.  
 Group VII, Rural Economics and Administration. Bibliography 1, 2; Civil Engineering 15; Economics 4a, 9, 12, 13, 18; English 3, 4, 13, 14; Law 3 or 6 units.

The following 4-year schedule is offered for the guidance of the student, and is advisory only. It may be varied to meet the individual needs, but elementary sciences should be taken early and attention given to prerequisites for the advanced courses.

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Eng. 1 or Modern Lang.....	3 or 4	Eng. 2 or Mod. Lang.....	3 or 4
Botany 1 or Chemistry.....	4	Botany 3 or Chem. 22.....	4
Mechanic Arts 1.....	2	Agr. Group Elective (Mech.	
Mathematics 1a.....	3	Arts 8, Bot. 4).....	4 to 7
Agr. 3 or Agr. Group		Agr. 2 or 26.....	3
Elective.....	3 or 4		
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
<hr/>		<hr/>	
16 $\frac{1}{4}$ to 18 $\frac{1}{4}$		15 $\frac{1}{4}$ to 19 $\frac{1}{4}$	

## SECOND YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Eng. or Mod. Lang. or		Eng. or Mod. Lang. or	
Free Elective.....	3 to 7	Free Elective.....	3 to 7
Botany 1 or Chem. 21.....	4	Botany 3 or Chem. 22.....	4
Math. 1b.....	3	Agr. 10, 18.....	4
Agr. 9 or Agr. Group Elec-		Agr. Group elective (Mech.	
tive (Mech. Arts 9).....	4 to 7	Eng. 14, Bot. 4).....	3 to 6
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
<hr/>		<hr/>	
15 $\frac{1}{4}$ to 18 $\frac{1}{4}$		15 $\frac{1}{4}$ to 18 $\frac{1}{4}$	

## THIRD YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mod. Lang. or Free elec.....	4	Mod. Lang. or Free elec.....	4
Physics 1.....	4	Physics 2.....	4
Agr. 9, 17, or Group elec. (C. E. 1 or 19).....	7 to 10	Agr. 6, 10, 18, or Group elec. (C. E. 20).....	7 to 10
	15 to 18		15 to 18

## FOURTH YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mod. Lang. or Free elec.....	4	Mod. Lang. or Free elec.....	4
Economics 1.....	3	Economics 2.....	3
Agr. 9, 17, or Group elec.....	3	Agr. 6, 10, 18, 24, or Group elec.....	8 to 11
	15 to 18		15 to 18

## TWO YEAR SHORT COURSE IN AGRICULTURE

Any student who shall have obtained 66 units of University credit of which 4 shall be in Military Science and not less than 40 units shall be in Agricultural Science and must include Botany 1, 3, and Agriculture 2 or 26, 3, 9, shall be eligible to a certificate for having completed the short course in Agriculture. Any person holding a Short Course certificate who shall have met the entrance requirements for the four year course in Agriculture, shall have junior rank.

Course Leading to the Degree of  
Bachelor of Science in Chemistry.

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Mathematics 1.....	6	Mathematics 2.....	6
German 1 or French 1.....	4	German 2 or French 2.....	4
Chemistry 1.....	4	Chemistry 2.....	4
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	18 $\frac{1}{4}$		18 $\frac{1}{4}$

## SECOND YEAR

Mathematics 3.....	4	Mathematics 4.....	4
German 3 or French 3.....	4	German 4 or French 4.....	4
Physics 1.....	4	Physics 2.....	4
Chemistry 3.....	4	Chemistry 4.....	4
Mech. Arts 1.....	2	Metallurgy 2.....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	19 $\frac{1}{4}$		19 $\frac{1}{4}$

## THIRD YEAR

Chemistry 5.....	4	Chemistry 6.....	4
Chemistry 7.....	4	Chemistry 8.....	4
Geology 13.....	2	Geology 14.....	2
Mineralogy 1.....	2	Mineralogy 3.....	2
Metallurgy 1, 7.....	4	Chemistry 9.....	2
		Elective .....	4
	<hr/>		<hr/>
	16		18

## FOURTH YEAR

Metallurgy 3.....	3	Metallurgy 4.....	4
Chemistry 14.....	2	Chemistry 15.....	2
Chemistry 10.....	2		
Thesis .....	2	Thesis .....	2
Elective .....	8	Elective .....	9
	<hr/>		<hr/>
	17		17

Total, 143 units.

Course Leading to the Degree of  
Bachelor of Science in Civil Engineering

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Math. 1 (Alg. and Trig.).....	6	Math. 2 (Analytic Geometry)..	6
*Chemistry 1.....	4	*Chemistry 2.....	4
Mech. Arts 1 (Mech. Drawing) 3		Mech. Arts 2 (Desc. Geom.)..	3
Mech. Arts 3 (Wood Shop)....	2	Mech. Arts 4 (Forge Shop)....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	<hr/>		<hr/>
	19 $\frac{1}{4}$		19 $\frac{1}{4}$

## SECOND YEAR

Math. 3 (Differential Calculus 4		Math. 4 (Integral Calculus)..	4
Physics 1.....	4	Physics 2.....	4
Mech. Arts 5 (Machine Shop) 2		Mech. Arts. 6 (Machine Shop) 2	
Civ. Eng. 1 (Surveying).....	4	Civ. Eng. 2 (Surveying).....	4
Elective .....	3	Elective .....	3
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	<hr/>		<hr/>
	18 $\frac{1}{4}$		18 $\frac{1}{4}$

\* Students who have not had preparatory or high school chemistry must take, in place of Chemistry 1, 2, Chemistry 21, 22, for which college credit will be given. In this case Mineralogy 7 can not be taken in the third year unless Chemistry 1, 2, is elected in the second year.

## THIRD YEAR

Math. 5 (Analytical Mechanics).....	5	Math. 6 (Anal. Mechanics)....	4
Astronomy 3.....	3	Physics 4 (Electrical and Optical Measurements).....	3
†Elective .....	3	Civ. Eng. 14a (Mechanics of Materials) .....	3
Civ. Eng. 11 (Hydraulics).....	4	Civ. Eng. 14b (Materials Laboratory) .....	1
Civ. Eng. 9 (R. R. Surveying).....	2	Civ. Eng. 10 (R.R. Surveying).....	2
		†Elective .....	4
	<hr/> 17		<hr/> 17

## FOURTH YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
Mech. Eng. 3 (Heat Engines).....	3	Mech. Eng. 4 (Pumping Machinery) .....	3
Civ. Eng. 7 (Steel Mill Buildings) .....	4	Civ. Eng. 6 (Masonry and Concrete) .....	4
Civ. Eng. 13 (Irrigation).....	4	Civ. Eng. 8 (Steel Bridges)....	4
Civ. Eng. 15 (Contracts, Specifications) .....	2	Civ. Eng. 18 (Sewerage).....	3
Civ. Eng. 17 (Water Supplies).....	2	Elective .....	2
Bacteriology .....	1		
Total, 141 units.	<hr/> 16		<hr/> 16

Course Leading to the Degree of  
Bachelor of Science in Electrical Engineering

## FIRST YEAR

English 1.....	3	English 2.....	3
Math. 1 (Alg. & Trig.).....	6	Math. 2 (Anal. Geom.).....	6
Chemistry 1 (or 21).....	4	Chemistry 2 (or 22).....	4
Mech. Arts 1 (Drawing).....	3	Mech. Arts 2 (Des. Geom.)....	3
Mech. Arts 3 (Wood Shop)....	2	Mech. Arts 4 (Forge).....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	¼	Physical Training.....	¼
	<hr/> 19¼		<hr/> 19¼

## SECOND YEAR

Math. 3 (Diff. Calculus).....	4	Math. 4 (Int. Calculus).....	4
Physics 1.....	4	Physics 2.....	4
Mech. Arts 5 (Mach. Shop)....	2	Mech. Arts 6 (Mach. Shop)....	2
Civ. Eng. 1 (Surveying).....	4	Mech. Eng. 2 (Mach. Design).....	2
Mech. Eng. 1 (Mechanism)....	2	Elec. Eng. 9 (Elem. Elec. Mach).....	3
Met. 1 (Iron and Steel).....	1	Elective .....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	¼	Physical Training.....	¼
	<hr/> 18¼		<hr/> 18¼

† In the third year 7 units of electives will be required, 1915-16 and thereafter. For students entering the University prior to 1913-14 the number of electives required in the third year is 5 units.



## THIRD YEAR

Math. 5 (Analytical Mech.)....	5	Math. 6 (Analytical Mech.)....	4
Mech. Eng. 3 (Heat Engines).....	3	Elec. Eng. 2 (Dynamo Elec. Mach.) .....	4
Elec. Eng. 1 (Elem. Elec. Eng.) .....	3	Civ. Eng. 14 (Mech. of Mat.).....	4
Civ. Eng. 11 (Hydraulics).....	4	Elec. Eng. 10 (Seminar).....	1
Elective .....	2	Elec. Eng. 11.....	2
		Elective .....	2

17

17

## FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.)....	2	Mech. Eng. 8 (Mech. Lab.)....	2
Elec. Eng. 3 (Elec. Mach.)....	2	Elec. Eng. 4 (Elec. Traction).....	2
Elec. Eng. 5 (Elec. Lab.)....	2	Elec. Eng. 6 (Elec. Lab.).....	2
Elec. Eng. 7 (Elec. Design)....	3	Elec. Eng. 8 (Elec. Sta. Design) .....	3
Elective .....	7	Mech. Eng. 12 (Power Plants).....	2
		Elective .....	5

16

16

Total, 141 units.

Course Leading to the Degree of  
Bachelor of Science in Mechanical Engineering

## FIRST YEAR

English 1.....	3	English 2.....	3
Math. 1 (Alg. & Trig.).....	6	Math. 2 (Anal. Geom.).....	6
Chemistry 1 (or 21).....	4	Chemistry 2 (or 22).....	4
Mech. Arts 1 (Drawing).....	3	Mech. Arts 2 (Des. Geom.).....	3
Mech. Arts 3 (Wood Shop)....	2	Mech. Arts 4 (Forge).....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$

19  $\frac{1}{4}$ 19  $\frac{1}{4}$ 

## SECOND YEAR

Math. 3 (Diff. Calculus).....	4	Math. 4 (Int. Calculus).....	4
Physics 1.....	4	Physics 2.....	4
Mech. Arts 5 (Mach. Shop)....	3	Mech. Arts. 6 (Mach. Shop).....	3
Mech. Eng. 1 (Mechanism)....	2	Mech. Eng. 2 (Mach. Design).....	2
Civ. Eng. 1 (Surveying).....	4	Elec. Eng. 9 (Elem. Elec. Mach.).....	3
Met. 1 (Iron and Steel).....	1	Elective .....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$

19  $\frac{1}{4}$ 19  $\frac{1}{4}$ 

## THIRD YEAR

Math. 5 (Analytical Mech.)....	5	Math. 6 (Analytical Mech.)....	4
Mech. Eng. 3 (Heat Engines).....	3	Mech. Eng. 4 (Pumping Mach.).....	3
Mech. Eng. 5 (Mach. Design).....	2	Mech. Eng. 6 (Mach. Design).....	2
Civ. Eng. 11 (Hydraulics).....	4	Civ. Eng. 14 (Mech. of Mat.).....	4
Elective .....	2	Seminar .....	1
		Elective .....	2

16

16



## FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.)....	3	Mech. Eng. 8 (Mech. Lab.)....	3
Mech. Eng. 9 (Design).....	2	Mech. Eng. 12 (Power Plants)	2
Civ. Eng. 7 (Steel Mill Bldg.)	4	Mech. Eng. 10 (Design).....	2
Elective .....	7	Civ. Eng. 6 (Concrete Masonry) .....	4
	16	Elective .....	5

Total, 141 units.

16

Course Leading to the Degree of  
Bachelor of Science in Mining Engineering and Metallurgy

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Chemistry 1.....	4	Chemistry 2.....	4
Math. 1a, 1b.....	6	Math. 2 (Anal. Geom.).....	6
Mech. Arts 1 (Drawing).....	3	Mech. Arts 2 (Des. Geom.)....	3
Mech. Arts 3.....	2	Mech. Arts 4 (Forge Shop)....	2
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	19 $\frac{1}{4}$		19 $\frac{1}{4}$

## SECOND YEAR

Chemistry 3.....	4	Chemistry 4.....	2
Math. 3 (Diff. Calc.).....	4	Math. 4 (Int. Calc.).....	4
C. E. 1 (Surveying).....	4	C. E. 2 (Surveying).....	4
Physics 1.....	4	Physics 2.....	4
Mineral 1 (Blow Pipe).....	2	Mineral. 3.....	2
Military Tactics.....	1	Metallurgy 2 (Assaying).....	2
Physical Training.....	$\frac{1}{4}$	Military Tactics.....	1
	19 $\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	19 $\frac{1}{4}$		19 $\frac{1}{4}$

Summer Work, Min. Eng. 7, six weeks' practical work and report.  
2 units or Min. Eng. 3a and 4a, 2 units.

## THIRD YEAR

Chem. 5.....	2	Chemistry 6.....	2
Math. 5 (Anal. Mech.).....	5	Math. 6 (Anal. Mech.).....	4
C. E. 11 (Hydraulics).....	4	C. E. 14 (Mat. Const.).....	4
Geology 1 (Gen. Geol.).....	3	Geology 2 (Gen. Geol.).....	3
Met. (7-5b) (Ore Dressing)...	4	Mineral. 4.....	3
		Min. Eng. 8 (Elements).....	2
	18		18

Summer Course, Geology 5-6 (Field Geology), 6 units.

## FOURTH YEAR

Mech. Eng. (Heat Eng.).....	3	E. E. 9 (Elec. Machinery).....	3
Min. Eng. 1 (General Mining)	2	Min. Eng. 2.....	2
Min. Eng. 3 (Laboratory).....	1	Min. Eng. 4.....	1
Min. Eng. 5 or Econ. 21.....	3	Min. Eng. 6.....	3
Geology 3 (Economic).....	3	Geology 4 (Ore Deposits)....	3
Met. 3-5a (Gold, Silver).....	4	Met. 4 (Gen. Met.).....	4
Mineral. 5.....	2	Mineral. 6.....	2

Total 149 units.

18

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### The Two Year Course in Commerce

Each subject is pursued through the year.

FIRST YEAR	UNITS	SECOND YEAR	UNITS
English 1, 2.....	3	Spanish .....	4
Elementary Accounting.....	2	Commercial Law.....	3
Economics 1, 2.....	3	Economics 5, 5a.....	3
Economics 3, 4.....	4	Economics 19, 20.....	3
History 1, 2.....	3	Business Practice.....	3
Military Tactics.....	1	Military Tactics.....	1
Physical Training.....	$\frac{1}{4}$	Physical Training.....	$\frac{1}{4}$
	<hr/> 16 $\frac{1}{4}$		<hr/> 16 $\frac{1}{4}$

### The Four Year Course in Commerce

Each subject is pursued through the year.

FIRST YEAR	UNITS	SECOND YEAR	UNITS
English 1, 2.....	3	Foreign Language.....	4
Foreign Language.....	4	Economics 3, 4.....	4
History 1, 2.....	3	Economics 5, 5a.....	3
Economics 1, 2.....	3	Science or Mathematics....	4 or 5
Accounting .....	2	Military Tactics.....	1
Military Tactics.....	1	Physical Training.....	$\frac{1}{4}$
Physical Training.....	$\frac{1}{4}$		
	<hr/> 16 $\frac{1}{4}$		<hr/> 16 $\frac{1}{4}$ or 17 $\frac{1}{4}$
THIRD YEAR	UNITS	FOURTH YEAR	UNITS
Law or Economics 7, 8.....	3	Economics 9, 10.....	3
History .....	3	English .....	2
Economics 19, 20.....	3	Econ. 15 or 16 (1st semester)	3
Economics 18.....	3	Econ. 12a-b.....	3
Elective .....	5	Suggested Optional Electives:	
		Law .....	3
		Psychology and Ethics.....	3
		Electives (1st semester) 2 or 3	
	<hr/> 17		<hr/> 16 or 17

Suggested Order of Studies for Candidates for the B. S. Degree  
Doing Major Work in Home Economics

#### FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	2
Physical Training.....	$\frac{1}{2}$	Physical Training.....	$\frac{1}{2}$
Elementary Training.....	2	Elementary Accounting.....	2
Elementary Food Prep.....	2	Elementary Food Prep.....	2
Elementary Clothing.....	3	Elementary Clothing.....	5
Electives .....	5	Elective .....	5
	<hr/> 15 $\frac{1}{2}$		<hr/> 15 $\frac{1}{2}$

## SECOND YEAR

Chemistry 1.....	4	Chemistry 2.....	4
Modern Language.....	4	Modern Language.....	4
Bacteriology .....	1	Home Cookery.....	3
Advanced Cooking.....	3	Economics 2.....	3
Economics 1.....	3	Drafting, Draping, etc.....	3
Physical Training.....	$\frac{1}{2}$	Physical Trining.....	$\frac{1}{2}$
	<hr/>		<hr/>
	15 $\frac{1}{2}$		17 $\frac{1}{2}$

## THIRD YEAR

Chemistry 16.....	4	Economics 8.....	2 or 3
Economics 7.....	2 or 3	Modern Language.....	4
Modern Language.....	4	Millinery .....	2
Dress Making.....	3	Chemistry of Foods.....	2
Electives .....	6	Chemistry of Textiles.....	3
		Electives .....	4
	<hr/>		<hr/>
	19		18

## FOURTH YEAR

Physiology 4.....	4	Physiology 5.....	4
Psychology .....	2	Pedagogy .....	2
Pedagogy .....	2	Psychology .....	2
Dietetics .....	2	Theory and Practice of Teach-	
Home Nursing.....	2	ing Home Economics.....	2
Electives .....	6	Electives .....	8
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	18		18

## ADVANCED DEGREES

Advanced degrees will be given only for work done in residence, to candidates who have received the Bachelor's degree from this institution or one of similar standing. Thirty units of such work, together with a thesis, will be required for the degrees of Master of Arts and Master of Science. The courses in each case will be laid out by those in charge of the departments in which the work for the degree is to be taken, and must be approved by a committee composed of all the heads of departments.

Students who expect to make mining engineering their profession are advised to take a fifth year, or a five-year course, since the four-year course gives insufficient time for a student to master all the subjects that are essential for the practice of mining engineering.

The requirements for the degree of Engineer of Mines are as follows:

Candidates must complete the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, as given by the University of Arizona, or the equivalent of this course in some school of recognized standing.

The fifth year's course will consist of not less than 30 units of resident work, to include (1) all of the following courses, the equivalent of which has not been taken by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy 1, 2, 3, 4; Mining Engineering 1, 2, 3, 4, 5, 6, 7, 8; Metallurgy 1, 2, 3, 4, 5, 7. (2) At least 8 units of graduate work in Mineralogy, Geology, Mining Engineering or Metallurgy. (3) The remainder of the 30 units may be chosen from any of the engineering departments, but should not be of lower grade than Junior work. Six months of work underground and in smelters, with a satisfactory detailed report on the same, will be required.

## COURSES OF INSTRUCTION

For the hours of classes the student is referred to the horarium issued at the first of the college year.

### AGRICULTURE

PROFESSORS CLOTHIER, MORSE, VINSON, WILSON, LAWRENCE AND  
MR. UPHOF

- 1, Principles of Plant Propagation. PROFESSOR CLOTHIER OR  
LAWRENCE

A thorough and practical training in the propagation of plants, including a study of soils used in the nursery and seed bed; seed testing; seeding and transplanting; and multiplying of plants by separation and division, cuttings, layerings, budding and grafting. Reference reading and the preparation of reports. Open to preparatory students.

One lecture and two 3 hour laboratory periods, second semester. 3 units.

2. Farm Crops. PROFESSOR CLOTHIER OR MORSE

A brief study of cereals and various other farm crops of the United States; a more detailed study of those that may be grown successfully in Arizona; commercial varieties, methods of culture, and market demands. Required, optionally with course 26, of all students in agriculture; open to preparatory students.

3 hrs., second semester. 3 units.

26. Horticultural Crops.

A study of vegetables and fruits with special reference to their adaptability and uses throughout Arizona. A general view of the principles and practices in horticulture, fitting the student for diversified farm work or for general science teaching. Required, option-

ally with course 2, of all students in agriculture. Open to preparatory students.

3 hrs., first semester. 3 units.

3. Live Stock Judging.

PROFESSOR WILSON

Judging different classes of horses, cattle, sheep and swine. Use of the score card; practice in comparative judging. Animals from the University herd are used, supplemented by live stock belonging to neighboring ranchmen and farmers. Required of all students in agriculture; open to preparatory students. Text: *Craig's Judging of Live Stock*. Reference: *Plumb, Beginnings in Animal Husbandry*.

3 hrs., first semester. 3 units.

4. Elements of Dairying.

PROFESSOR WILSON

Secretion and composition of milk and causes of variation in composition; the Babcock test of milk; various methods of cream raising, including a study of the construction and operation of centrifugal separators; methods of making and marketing butter; proper handling of milk on the farm; testing milk and other dairy products; operating different makes of cream separators, and making butter. Open to preparatory students.

3 hrs., second semester. 3 units.

5. Home and Market Gardening. PROFESSOR CLOTHIER OR MORSE

Practical and theoretical training in the general principles underlying successful intensive farming; detailed study of the various crops grown in the home and market garden, with special reference to Arizona conditions. Lectures, laboratory and practice on the farm.

3 hrs., first semester. 3 units.

6. Plant Breeding.

MR. UPHOF

The general principles of plant breeding; detailed study of the methods pursued and results obtained by leading plant breeders in various experiment stations and in private work. Prerequisite, Botany.

1. Required, optionally with course 17, of all students in agriculture.

3 hrs., second semester. 3 units.

7. Dry Farming.

PROFESSOR CLOTHIER OR MORSE

Rainfall and other climatic conditions in the various dry farming regions of the world. General dry farming methods; crops adapted to dry farming; dry farming methods and possibilities in Arizona. Review of bulletins dealing with experimental work; lectures and library work. Prerequisites, Agriculture 2 and 9.

3 hrs., first semester. 3 units.



## 9. Soil Physics.

PROFESSOR CLOTHIER OR VINSON

Origin, composition and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture and plant food; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in agriculture.

3 lectures and one 3-hour laboratory period, first semester. 4 units.

## 10. Soil Fertility.

PROFESSOR CLOTHIER OR MORSE

Amount and availability of the various elements of plant food in soils; relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; making and using farm manures; crop rotations; the Rothamstead experiments; theory of toxic substances in soils. Required of all students in agriculture. Lectures and laboratory work. Prerequisites, Chemistry 21, 22, Agriculture 9.

3 lectures and one 3 hour laboratory period, second semester. 4 units.

## 11. History of Breeds.

PROFESSOR WILSON

Characteristics of each breed of horses, cattle, sheep, swine and goats; origin, history and development, introduction to America, and adaptability to Arizona conditions. Open to preparatory students. Text: Plumb's *Breeds of Farm Animals*.

3 hrs., second semester. 3 units.

## 12. Poultry Husbandry.

PROFESSOR WILSON

General care and management of poultry, production of poultry for the market, diseases and pests, breed characteristics. Recitations, lectures and laboratory work, including visits to poultry ranches. Open to preparatory students.

3 hrs., first semester. 3 units.

## 13. Pomology.

PROFESSOR CLOTHIER OR LAWRENCE

Orchard management, and detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties; fruit judging. Lectures and laboratory work.

4 hrs., first semester. 4 units.

## 14. Citrus Fruits.

PROFESSOR CLOTHIER OR LAWRENCE

Culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Lectures and laboratory work.

4 hrs., second semester. 4 units.



## 15. Veterinary Physiology.

PROFESSOR WILSON

Special physiology of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory.

3 hrs., first semester. 3 units.

## 16. Animal Diseases.

PROFESSOR WILSON

(a) General and specific causes of diseases and methods of prevention; errors in feeding and in care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations. (b) Diagnosis and treatment of common ailments of farm animals. (c) Simple operations. Text-book: Mayo's *Care of Animals*. Lectures, recitations, and clinics.

3 hrs., second semester. 3 units.

## 17. Animal Breeding.

PROFESSOR WILSON

Principles of breeding, including selection, heredity, atavism, reversion, variation, correlation, with a presentation of methods of breeding, such as line breeding, in-breeding, in-and-in breeding, cross breeding. Required, optionally with course 6, of all students in agriculture. Prerequisites: Botany 1 or Zoology 1, Agriculture 3 or 11.

3 hrs., first semester. 3 units.

## 18. Feeds and Feeding.

PROFESSORS WILSON AND VINSON

Principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical feeding of animals for various purposes. Prerequisite; Chemistry 21, 22. Required of all students in agriculture.

4 hrs., second semester. 4 units.

## 19. Small Fruits.

PROFESSOR CLOTHIER OR LAWRENCE

Small fruits such as the strawberry, the grape and the various bush fruits.

3 hrs., first semester. 3 units.

## 20. Horticultural Literature. PROFESSOR CLOTHIER OR LAWRENCE

Assigned readings in bulletins and standard works upon horticulture; daily and weekly reports presenting a comprehensive view of the general field of horticulture and laying the foundation for research work. Open to junior and senior students.

3 hrs., second semester. 3 units.

## 21. Advanced Live Stock Judging.

PROFESSOR WILSON

Show yard judging; relation of pure bred live stock to market classes; method of comparative judging. Trips are made to large herds, and students are required to spend several days at the State

Fair at Phoenix, judging live stock. Prerequisites: Courses 3 and 11.  
3 hrs., first semester. 3 units.

22. Animal Husbandry Literature. PROFESSOR WILSON

A study of books and magazines and a review and compilation of bulletins devoted to animal husbandry. Required use of the herd books of the different breeders' associations in studying the pedigrees of the best individuals in the more popular breeds of horses, cattle, sheep and swine. Open to junior and senior students.

3 hrs., second semester. 3 units.

23. Agronomy Literature. PROFESSOR CLOTHIER OR MORSE

Daily and weekly reports upon assigned readings in bulletins and standard works, to round out the student's knowledge of the general field of agronomy, and to prepare the way for research in the subject. Open to junior and senior students.

24. Farm Management. PROFESSOR CLOTHIER OR MORSE

Purchase, organization, equipment and management of farms with reference to financial returns; farm accounts, market demands, marketing associations; the farm lay-out, farm buildings, leveling for irrigation, location and management of ditches, are among the subjects to be discussed. Required of all students in agriculture.

2 lectures and one 3-hour laboratory period, second semester. 3 units.

25. Meat Production. PROFESSOR WILSON

Economic production of meats; fitting, showing, and care of animals for exhibition purposes; farm butchering; selection of animals for the feed yard, show ring, market and butcher. Prerequisite: Agriculture 3.

2 lectures, 1 laboratory period of 3 hrs., first semester 3 units.

SHORT COURSE IN AGRICULTURE

This course is offered to meet the demands of prospective home-seekers in Arizona; to give the student unable to afford the time or the means to pursue a full college course a brief introduction to successful farming, and to give him a measure of that general culture incidental to University life, which makes for good citizenship. It equips young men to fill expert positions, which are now open in Arizona and which will become more frequent as the great reclamation projects are completed. The University from time to time has calls for farm managers at good salaries, and such calls will increase in number. Vast areas of desert land in Arizona may be reclaimed

by pumping, the development of which has scarcely been touched; but to make the most of such opportunities one will need more mechanical skill and more knowledge of the physical properties of soil than the average farmer possesses. Courses in Irrigation Engineering, Farm Management, Soil Physics, Vegetable Gardening, Orchard Management, and Farm Dairying equip young men to take advantage of these opportunities and positions.

Students will be admitted to the short course who have a general knowledge of the common school branches and sufficient maturity to understand the value of their time and opportunity. They enjoy the same privileges, and observe the same regulations as other students registered in the University.

The University is amply equipped with library, laboratory, and green-house facilities, and the theoretical knowledge gained therein and in class-work has an abundance of practical application on the University farm of 80 acres.

#### ART

##### ASSISTANT PROFESSOR NEWSOM

##### History of Painting.

A general survey of the history of painting, as follows: Early Christian and Byzantine, Italian, Spanish, Dutch and Flemish, French, German, English, American. Examination and comparison of the methods of each school and period; a critical study of the great masters, their environment, their works and their influence. Characteristic details of style are studied from photographs and plates. Lectures by the instructor; investigation and reports on assigned topics by students. Not open to freshmen.

3 hrs., each semester. 3 units, each semester.

#### ASTRONOMY

##### PROFESSOR DOUGLASS

##### 1, 2. Descriptive Astronomy.

PROFESSOR DOUGLASS

The sun, moon, planets, and other celestial objects, with constant views of their telescopic appearance, and discussion of the latest theories of the evolution of the universe and the condition of the planets. Non-mathematical; open to all students.

2 hrs., or an equivalent, first and second semesters. 2 units, each semester.

## 3. Engineering Astronomy.

PROFESSOR DOUGLASS

Latitude, longitude, and time observations, and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Course 3 is required of juniors in civil engineering.

3 hrs., or an equivalent, first semester. Two day hours and one evening hour. 3 units.

## BACTERIOLOGY

PROFESSOR MESERVE

A brief laboratory course teaching the elements of microscopical and culture methods of examination and removing the ordinary misconceptions concerning bacteria, rather than developing bacteriologists. Special attention to milk and water examination; the widespread influence of bacteria and yeasts on our daily life. Required of civil engineering and domestic arts students, freshman chemistry being a prerequisite.

Two 2 hour periods a week during the first half of the first semester. 1 unit.

## BIBLIOGRAPHY

ASSISTANT PROFESSOR LUTTRELL

1. Use of Books and Elementary Bibliography. Classification; card catalogues; the more common reference books; bibliographies, indexes, dictionaries, cyclopedias. Open to freshmen and sophomores. Lectures, exercises, preparation of bibliographies.

2 hours, first semester. 2 units.

2. The Library and the School. Library administration, small school libraries, selection and ordering of books, sales catalogues, library routine. Primarily for students intending to teach. Lectures and practice work.

2 hours, second semester. 2 units.

## BOTANY

PROFESSOR THORNER, MR. BROWN

## 1. Elementary Botany.

MR. BROWN

A general view of the four great groups of plants; the morphology of types and their genetic relations; the gross and microscopic structure of plant organs, and the microscopic study of cell structure and phenomena including karyokinesis. Open to college students and required of all agricultural students. Text: *Practical Botany*, Bergen and Caldwell.

## 2. Plant Histology.

MR. BROWN

Microscopy, botanical microtechnique, use of the camera lucida, and the photographic camera. The greater part of the laboratory work is given to the use of chemical reagents and stains in the preparation of microscopic slides. For students who intend to teach botany or to take advanced work in this subject. Text: Chamberlain's *Methods in Plant Histology*. Prerequisite Botany 1.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

## 3. Plant Physiology.

MR. BROWN

Life processes of plants. Investigations of the properties of protoplasm; relations of plants to mechanical forces; influence of chemicals upon plants; relations of plants to water, gravitation, light, respiration, growth and movement. For students of plant physiology, because of our interesting flora and climatic conditions. Required of students in horticulture and agronomy. Text: MacDougal's *Text-book of Plant Physiology*. Prerequisite, Botany 1.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

## 4. Taxonomy.

PROFESSOR THORNER

Identification of plants. For those who expect to continue the study of botany, as well as for those who desire to know the common plants about them, both native, and cultivated species. Particular attention to economic plants. Excursions to adjacent mountains, mesas and river valleys. Texts: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*; Gray's *Field, Forest and Garden Botany*; also numerous other reference works. Open to college students.

2 lectures and 6 hours of laboratory work, second semester. 4 units.

## 5. Taxonomy.

PROFESSOR THORNER

Continuation of course 4. Systematic study of our flora; citation of plant types and co-types; herbarium building; the art of keying plant groups. Original literature is used. Different systems of classification are studied. Open to students who desire to continue the study of taxonomy.

## 6. General Morphology of Algae and Fungi.

MR. BROWN

Open to students who have completed courses 1 and 2. The instructor must be consulted before registration. Prerequisites, Botany 1 and 2. Hours to be determined. 4 units.

## 7. General Morphology of Bryophytes and Pteridophytes. 4 units.

## 8. General Morphology of Spermatophytes. 4 units.



## 9. History of Botany.

MR. BROWN

A lecture course dealing with (a) early descriptive botanists; (b) the period of artificial systems; (c) the beginning and development of modern botany; (d) botany and botanists of today. This course requires library work. Prerequisites, Botany 1, 2, 3 and 4.

First semester. 4 units.

## 10. Grazing Range Studies.

PROFESSOR THORNER

An economic study of the native grasses, saltbushes, cacti and other forage plants, particularly as concerns their grazing value. Different types of ranges with the relation of rainfall to plant growth; the open range as contrasted with the advantages of fenced ranges. Poison plants and range weeds with means of eradication. Range restoration. Recommended for students in animal husbandry and general agriculture. Prerequisite, Botany 4.

2 lectures and 6 hours of laboratory work, first semester. 4 units.

## 11. Plant Pathology.

PROFESSOR THORNER

The principal groups of parasitic fungi and the plant diseases caused by them, together with methods of control. External factors causing pathological conditions in plants. The commoner plant diseases throughout the country. Prerequisites, Botany 1 and 3.

1 lecture and 5 hours laboratory work, first semester, 3 units.

## 12. Plant Pathology.

Continuation of course 11. Second semester. 3 units.

## 13. Geographical Botany.

MR. BROWN

Plant distribution over the earth's surface, with reasons for such distribution. General aspect of the vegetation characteristic of the hygrophytic forest, the tropophytic forest, the sclerophyll forest, the savannah, the steppe, the desert, the tundra. A considerable amount of reading in addition to classroom and field work is required. The lectures are frequently illustrated. Prerequisite, Botany 4. No laboratory work.

4 hours, first semester. 4 units.

## 14. Landscape Gardening.

PROFESSOR THORNER

Native and introduced flowers, vines, shrubs, and trees adapted for growing under southwestern conditions; lawn making, the rose garden, and hardy bulbous species. Different types of landscape gardening, aesthetic arrangement of trees and shrubs in country and urban homes to secure the best results in planting.

3 lectures and 2 laboratory hours, first semester. 4 units.

## CHEMISTRY

PROFESSOR GUILD, ASSOCIATE PROFESSOR BRINTON AND MR. COCHRAN.

- 21, 22. Beginning General Chemistry. ASSOCIATE PROFESSOR BRINTON AND MR. COCHRAN

A beginning course intended for students who enter without a year of high school chemistry. An approach to the study of chemistry from the laboratory standpoint. Textbook: Stoddard, *Introduction to General Chemistry*.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

- 1, 2. Advanced General Chemistry and Qualitative Analysis.

PROFESSOR GUILD, ASSOCIATE PROFESSOR BRINTON AND MR. COCHRAN

Lectures and recitations illustrating the chemical properties of the elements and their compounds. Textbooks: Mellor, *Modern Inorganic Chemistry*; Tower, *Qualitative Chemical Analysis*, and various reference books. Open to all students who have taken courses amounting to one year each in preparatory chemistry and physics.

4 hrs., or an equivalent both semesters. 4 units, each semester.

3. Quantitative Analysis. ASSOCIATE PROFESSOR BRINTON

Laboratory practice, with lectures and recitations; the work is chiefly in gravimetric methods of analysis. For students in agriculture, special problems in agricultural chemistry, such as analysis of water, soils, and fertilizer are considered. Open to all students who have taken Chemistry 2.

4 hrs., or an equivalent, first semester. 4 units.

4. Volumetric Analysis. ASSOCIATE PROFESSOR BRINTON

A continuation of the work in Chemistry 3, special attention being given to fundamental principles of volumetric analysis and thorough drill in the stoichiometric relation of standard solutions.

4 hrs., or an equivalent, second semester. 2 units if discontinued after eight weeks; otherwise, 4 units.

- 5, 6. Special Quantitative Analysis. ASSOCIATE PROFESSOR BRINTON

A course in technical analysis. Special attention to the methods of wet assaying employed in the West, and to the analysis of water, gases, oils, minerals, iron and steel and other industrial products.

2 or 4 hrs., or an equivalent, both semesters. 2 or 4 units, each semester.

## 7, 8. Organic Chemistry. PROFESSOR GUILD

Lectures on the carbon compounds; laboratory work in analysis, vapor density and molecular weight determination. Open to students who have taken Chemistry 2.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

## 9. Inorganic Preparations. ASSOCIATE PROFESSOR BRINTON

Preparation of pure chemical compounds from the crude materials. Open to students who have taken Chemistry 4.

2 hrs., or an equivalent, second semester. 2 units.

## 10. Physical Chemistry. PROFESSOR GUILD

Lectures and laboratory work. Application of physico-chemical methods to the study of such problems as the determination of molecular weights, vapor densities, reaction velocity, conductivity, electromotive force, etc. Open to students who have taken Chemistry 3.

2 hrs., or an equivalent, first semester. 2 units.

## 11, 12. Chemistry of the Rare Elements. PROFESSOR GUILD

Analysis and synthesis of uranium, molybdenum, tungsten, vanadium and cerium compounds. Open to students who have taken Chemistry 6, 9.

4 hrs., or an equivalent, both semesters. 4 units, each semester.

## 13. Special Chapters of Inorganic Chemistry.

ASSOCIATE PROFESSOR BRINTON

Lectures and laboratory practice on selected topics from the field of recent work in inorganic chemistry. Open to students who have taken Chemistry 3. Chemistry 9 is advised as preparation for this course.

2 hrs., or an equivalent, second semester. 2 units.

## 14, 15. Industrial Chemistry. ASSOCIATE PROFESSOR BRINTON

Lectures and recitations on the application of chemistry to the processes of modern industry and manufacture.

2 hrs., both semesters. 2 units each semester.

## 16. Introductory Quantitative Analysis.

ASSOCIATE PROFESSOR BRINTON

A special course in gravimetric and volumetric analysis for students in agriculture and home economics. Textbook, Lincoln and Walton, Elementary Quantitative Chemical Analysis. A prerequisite for the course in Food Chemistry.

4 hrs., or an equivalent, first semester. 4 units.

## CIVIL ENGINEERING

## PROFESSOR WATERBURY AND ASSISTANT PROFESSOR KELTON

Some of the courses in civil engineering are offered on a consultation basis. For such courses the class does not meet in a body and periods will not be scheduled. Each student arranges with the instructor for the required consultation periods. In general, two or three consultation periods a week, in each subject, are required of each student. For courses requiring laboratory or drafting work the student must spend as much time in the laboratory or drafting room as may be required to complete the assigned work.

## 1. Elementary Surveying. ASSISTANT PROFESSOR KELTON

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, drawing, and field work. Open to students who have taken trigonometry, and who have taken or are taking Mechanic Arts 1.

3 hrs., and Sat. A. M., first semester. 4 units.

## 2. Topographic and Mine Surveying.

ASSISTANT PROFESSOR KELTON

A continuation of Civil Engineering 1. Topographic surveying, hydrographic surveying, patent surveys, and underground surveying. Open to students who have taken Civil Engineering 1.

3 hrs. and Sat. A. M., second semester. 4 units.

## \*3. Geodesy.

PROFESSOR WATERBURY

Precise triangulation work, including measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2, and Astronomy 3 or 4. This course may be taken as a consultation course.

1 hr., first and second semester. 1 unit.

## 6. Concrete and Masonry Construction. PROFESSOR WATERBURY

Theory and practice in reinforced concrete construction. Foundations on land and in water, cofferdams, cribs, caissons, piers, and abutments, retaining walls, dams, and arches. Textbook: Baker, *Masonry Construction*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. 4 units.

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\*To be omitted 1914-15.

## 7. Steel Mill Buildings.

PROFESSOR WATERBURY

Graphical and analytical computation of stresses in roof and bridge trusses; details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Textbook. Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, first semester. 4 units.

## 8. Bridge Design.

PROFESSOR WATERBURY

Computation of stresses due to moving loads upon various points of bridge structures; a detailed study of bridge designs and bridge erections; complete investigation with drawings, estimate of weights, and estimate of cost of a steel bridge. Textbook: Ketchum, *Design of Highway Bridges*. Open to students who have taken Civil Engineering 7. This course may be given as a consultation subject.

2 hrs., and two 3-hr. drafting periods, second semester. 4 units.

## \*9, 10. Railroad Engineering.

ASSISTANT PROFESSOR KELTON

Preliminary and location surveys; simple and easement curves, turnouts and switches; principles of economic location as based upon cost of construction, operating expenses, alignment, and grades, maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations and estimates of cost. Textbook: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2.

1 hr., and one 4-hr. field or drafting period, both semesters. 2 units each semester.

## 11. Hydraulics.

PROFESSOR WATERBURY

Velocity and discharge from orifices, weirs, tubes, and pipes; flow in sewers, ditches, canals and rivers; measurement of water power; water wheels of various types. Textbook: Merriman, *Hydraulics*. Open to students who have taken Civil Engineering 1, 2 and Mathematics 4.

4 hrs., first semester. 4 units.

## 13. Irrigation Engineering.

ASSISTANT PROFESSOR KELTON

Engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measur-

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\*To be omitted 1914-15.



ing, and pumping water for use in irrigation. Textbook: Wilson, *Irrigation Engineering*. Open to students who have taken Civil Engineering 1, 2, 11, 14.

3 hrs., and one 3-hr. laboratory and drafting period. This course may be given as a consultation subject. First semester, 4 units.

14a. Mechanics of Materials. PROFESSOR WATERBURY

Analysis and computation of stresses in prisms, beams, columns, and shafts. Textbook: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6.

3 hrs., second semester. 3 units.

14b. Materials Testing. ASSISTANT PROFESSOR KELTON

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil Engineering 14a.

One 3-hr. laboratory period, second semester. 1 unit. 2 units additional may be elected, hours to be arranged.

\*15. Contracts and Specifications. PROFESSOR WATERBURY

Essentials of a contract; items included in various kinds of engineering contracts and specifications; preparation of a complete set of specifications and a contract. Textbook: Johnson, *Engineering Contracts and Specifications*. Open to all college students. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

16. Thesis. PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student is permitted to register in this subject unless his previous work has been of high grade. Open to senior students in civil engineering.

First or second semester. 2 units.

\*17. Public Water Supplies. PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water; methods of purification of water; and a study of the design of water systems. Textbooks: Turneure and Russell, *Public Water Supplies*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject.

2 hrs., first semester. 2 units.

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\*To be omitted 1914-15.

**\*18. Sewerage.****ASSISTANT PROFESSOR KELTON**

Methods of sewerage purification; sewerage disposal plants; and design of sewer systems. Textbook: Folwell, *Sewerage*. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject.

3 hrs., first or second semester. 3 units.

**19. Agricultural Surveying.****ASSISTANT PROFESSOR KELTON**

An elementary course in surveying for students in agriculture. The construction and use of surveying instruments; surveying operations having particular application in agricultural and irrigation work. Open to students who have had high school or preparatory algebra.

2 hrs. and one 3-hr. field period, first semester. 3 units.

**20. Principles of Irrigation.****ASSISTANT PROFESSOR KELTON**

Methods of irrigation, measuring water for use in irrigation, present condition of irrigation development in the United States, irrigation legislation, and methods of establishing water rights. Open to students who have had Civil Engineering 19.

**\*22. Highway Engineering.****PROFESSOR WATERBURY**

Highway location and construction; construction of city pavements; bituminous materials for dust prevention and road preservation. Prerequisite, Civil Engineering 1.

2 hrs., second semester. 2 units.

**ECONOMICS****PROFESSOR CHANDLER AND MR. HUBBARD****1, 2. Introduction to Economics.****PROFESSOR CHANDLER**

The general principles underlying the science, with emphasis upon practical application, in business, industry and the home. The elements of fundamental lines of business activity that are important to all who have to earn a living or manage a home, including: Markets and buying; retail and wholesale prices; life and fire insurance; taxation; credits; transportation; elements of cost; principles of labor efficiency. Because of local importance much attention is given to the application of economic principles to mining and agriculture. Open to all college students.

3 hrs., each semester. 6 units.

**3. Industrial and Commercial Organization.****PROFESSOR CHANDLER**

The scientific basis of large scale industry through analysis of the

\*To be omitted 1914-15.

principles of competition, combination, monopoly and the savings of integration; various business units from the point of view of comparative efficiency for different kinds of business; methods of business consolidation; scientific management and elements of cost. Materials of commerce and commercial geography with reference to foreign trade and competition. The Tariff System. Prerequisite, Economics 1, 2.

4 hrs., first semester. 4 units.

\*4. Transportation and Commerce. PROFESSOR CHANDLER

1. The materials of commerce, American commercial geography, raw products and other material sources of American business and transportation.

2. Rise of the American railway system; its past and present relation to the development of agriculture, mining, manufacturing and other industries.

3. The business organization, methods of combination, and financial operations of the American railway system.

4. Relation of the railroad to the government and the public; rights of the shipper; railway rates.

Open to those who have had Economics 1, 2.

4 hrs., second semester. 4 units.

4a. Business Economics for Engineers.

PROFESSOR CHANDLER AND MR. HUBBARD

Especially for engineering students and others who have only a limited time to study economics. Special problems of capital, labor and organization of importance to the engineer who may enter the business side of mining, transportation, manufacturing and other industrial work. Not open to students who have had courses 3, 4 or 5.

2 hrs., 2 units.

†5. Corporation Organization and Finance. PROFESSOR CHANDLER

1. Organization and management; how and where to organize; powers and privileges of corporations in the different states; minority rights.

2. Business development and promotion of various properties and enterprises, with special reference to the promotion and development of mining companies.

3 hrs., first semester. 3 units.

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\*Offered in 1914-15 and alternate years.

†Offered in 1913-14 and alternate years.

†5a. Financial Institutions and Investments. PROFESSOR CHANDLER  
A study of the investment market, including:

1. Financial agents and institutions; stock brokers; stock exchanges; stock market; money market.

2. Investments of securities; methods and laws of investment and speculation; relative merits of railway stocks, bonds, municipal bonds, industrial, irrigation and mining securities.

3 hrs., second semester. 3 units.

7. Sociology and Social Reform. PROFESSOR CHANDLER

An introduction to the study of society and social problems including: Principles of social evolution; the social function of the home and the family; the problem of the dependent, the defective and the delinquent; modern methods of social service and scientific social reform. Open to all college students.

3 hrs., first semester. 3 units.

8. American Politics. PROFESSOR CHANDLER

Underlying principles and practical methods of Federal, State and municipal government and politics; platforms and organization of political parties; modern methods of expert government and administration; legislative reference work, and bureaus of public efficiency.

3 hrs., second semester. 3 units.

†9. Labor Problems. PROFESSOR CHANDLER

1. Origin of the labor problem and history and growth of labor organizations.

2. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of living of American workmen; sweating system; poverty and unemployment.

3. Organized labor vs. organized capital; strikes and lockouts; closed vs. the open shop; collective bargaining; employers' organizations.

4. Political and legal aspects; use and abuse of the injunction; police power of the state; the laborer in politics.

3 hrs., first semester. 3 units.

†10. Economic Reform Movements. PROFESSOR CHANDLER

This course logically follows Economics 9. The labor question

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†Offered in 1913-14 and alternate years.

with emphasis upon the constructive side. The chief proposals for the solution in America, Europe and Australia; profit sharing; co-operation; industrial education; compulsory arbitration; labor legislation in the United States.

3 hrs., second semester. 3 units.

12. Public Questions.

PROFESSOR CHANDLER

Students receive training in the handling of public questions, political, economic and social, by means of discussions and reports. Open to all students who have had Economics 1, 2, or 7, 8.

1 hr., first semester. 2 units.

12a, 12b. Seminar in Arizona Problems.

PROFESSOR CHANDLER

Open only to advanced students.

1-3 hrs., credit, each semester.

13, 14. Elementary Accounting.

MR. HUBBARD

An introductory study of simple accounts; the general principles of accounting, meaning of the balance sheet and other reports furnished by firms and corporations, and accounting problems incident to efficient business management. Concrete examples, with special attention given to farm, engineering, and cost accounting. Open to all college students.

2 hrs., both semesters. 2 units, each semester.

\*15. Advanced Accounting.

MR. HUBBARD

2 hrs., first semester. 2 units.

\*16. Municipal Problems.

PROFESSOR CHANDLER

The city in its economic, political, and social aspects.

3 hrs., first semester. 3 units.

18. Agricultural Economics.

MR. HUBBARD

Business aspects of rural life; capital and labor as applied to farming, irrigation, forestry and mineral lands; agricultural banking and credit; buying of supplies and marketing of products; the public domain, state and national.

Students of agriculture, who have not taken the work in course 13, covering agricultural accounting, will be given in this course a simplified system of farm accounts.

3 hrs., first or second semester. 3 units.

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\*Offered only in alternate years,—course 15 in 1914-15; course 16 in 1915-16.



## 19. Money and Banking.

MR. HUBBARD

Functions of money and its relation to credit institutions; monetary system of the United States; theory and history of banking; function of the savings bank, the trust company, the clearing house; history of American finance; financial crises in their relation to our present currency and banking systems; examination of the principal banking systems of the world for the purpose of finding ideas which would render the American system more nearly conformable to our growing financial and commercial needs. Open only to juniors and seniors who have had at least one year of economics.

3 hrs., first semester. 3 units.

## 20. Business Economics.

PROFESSOR CHANDLER AND MR. HUBBARD

Insurance, real estate and taxation.

3 hrs., second semester. 3 units.

## 21, 22. Principles and Economics of Mining.

PROFESSOR CHANDLER AND PROFESSOR WILLIS

Especially for students of Mining Engineering, and given jointly with the department of Mining Engineering. Same as Mining 5, 6. Not open to students who have had Economics 5 and 5a or Economics 4a.

3 hrs., throughout the year. 6 units.

## BUSINESS COURSES IN THE UNIVERSITY

The University now offers two courses in Business, Economics, Commerce and Finance; a two year course in practical business economics leading to a certificate; and a four year course leading to the degree of B. S. in Economics.

The Two Year Course in Business is offered especially for those high school graduates who wish to prepare for business life and who cannot afford to take a four year course in commerce. Emphasis is placed upon the more practical phases of business training. Any subject in the two year course will be accepted for full credit in the four year course. One of the valuable features of this course consists of talks given by business men to the students. In the past talks have been given by men who have had experience in business administration, organization, real estate, fire insurance, life insurance, salesmanship, banking, and trust business.

The Four Year Course in Business Economics, leading to the degree of B. S. in Commerce, is offered to meet the growing demands of

the business world for men who are equipped with technical knowledge of finance, business organization and administration. In addition to all that is given in the Two Year Course, the student is required to elect science or mathematics, and more foreign language. Entrance requirements are the same as for the A. B. degree.

#### ELECTRICAL ENGINEERING

PROFESSORS HENLEY AND ALDRICH, MR. SNOW

Work in electrical engineering proper is not undertaken until the Junior year, but a course in electricity and magnetism may be elected in the Sophomore year. Courses are given in other engineering subjects, and electives give opportunity for work along non-engineering lines.

1. Elements of Electrical Engineering. MR. SNOW

The principles of the development of electrical engineering; a brief history of the development of the electrical industry, with modern applications of electricity to transmission of power, electrical lighting, the telephone, street cars, etc.; the theory of the generation and transmission of both direct and alternating currents,—advantages and disadvantages in the use of each.

First semester, junior year. 3 units.

2. Dynamo-Electric Machinery. MR. SNOW

In part a continuation of E. E. 1. The study of electric illumination, comparing the various light sources, their relative values under different conditions, cost and efficiency of operation. One 3-hour period in the laboratory, making different connections on motors and generators, running machines and making simple tests of them.

Second semester, junior year. 4 units.

3. Electrical Machinery. MR. SNOW

The fundamental laws of electromagnetic and electrostatic circuits. Algebraic and geometric treatment of electrical problems, in such a manner that an analysis of the structural and performance characteristics of electrical machinery may be easily followed.

2 hrs., first semester, senior year. 2 units.

4. Electric Traction. MR. SNOW

Practical application of E. E. 3 to generators, motors, and transformers. Electric railways: the railways, generators, rotary-converters, the different types of motors as applied to the work; a comparison of the direct and alternating current systems in electric railroad work.

2 hrs., second semester, senior year. 2 units.

5, 6. Electrical Engineering Laboratory. MR. SNOW

Operation and characteristics of commercial machines, making complete tests of generators, motors both direct and alternating current, transformers, synchronous converter; actual operation of the machines, common causes of trouble and their remedy.

Two 3-hr. periods, each semester, senior year. 2 units.

7. Design of Electrical Machinery and Apparatus. MR. SNOW

Paralleling E. E. 3. Effect of design on the characteristics, cost of operation and performance of electrical machinery and apparatus. Practical calculations for designing lifting magnets, finding and plotting the characteristics and predetermination of the operation of generators, motors, transformers and transmission lines.

Two 3-hr. periods and one lecture, first semester, senior year. 3 units.

8. Electric Power Station Design. MR. SNOW

Selection and arrangement of electric power station equipment; wiring diagrams and switch-board connections. Transmission line design, calculations of cost of operation, estimated cost of power delivered, and power rates.

Two 3-hr. periods and one lecture, second semester, senior year. 3 units.

9. Electrical Engineering Practice. MR. SNOW

A general course in electrical engineering for all engineering students; electric lighting, transmission and distribution, construction and operation of alternating and direct current generators and motors.

2 hrs., and one 3-hr. laboratory period, either semester. 3 units.

10. Seminar. PROFESSORS HENLEY AND ALDRICH, MR. SNOW

Discussion of various subjects which arise in connection with work, and review of current engineering literature.

1 hr., second semester. 1 unit.

11. Elements of Design. MR. SNOW

A drafting room course for junior electrical students.

2 3-hr. periods, second semester. 2 units.

## ENGLISH

PROFESSOR BATES, PROFESSOR PERRY, ASSISTANT PROFESSOR LUTRELL

## English Composition

1. Exposition. PROFESSOR PERRY

Lectures and the study of Perry's *Exposition*; daily and weekly themes. Prescribed for freshmen.

3 hrs., first semester. 3 units.

2. Argumentation. PROFESSOR PERRY

Study of Perry's *Argumentation*. Class debates and written arguments, instruction in the right use of authorities, use of catalogues and indexes. Prescribed for freshmen.

3 hrs., second semester. 3 units.

- 11, 12. Methods of Teaching English. PROFESSOR PERRY

For students preparing to teach English in secondary schools. Methods of teaching grammar, rhetoric, composition, literature, discussion of college entrance requirements in English; blocking out of courses, and planning and presenting of single lessons.

3 hrs., both semesters. 3 units each semester.

19. Advanced Courses in Methods of Teaching English.

PROFESSOR PERRY

For seniors who as juniors took English 11 and 12. A review and a continuation of the work of that course.

2 hrs., second semester. 2 units.

20. Narration (formerly 13). PROFESSOR PERRY

The writing of short stories. Consideration of the problems of the short story writer; the discovery, through the analysis of specimen stories, of helpful principles and devices, and experimentation in their application in short story writing. Frequent themes. Open to college students who have successfully completed English 1 and 2.

3 hrs., second semester. 4 units. Not offered 1914-1915.

21. Public Speaking (formerly English 14) PROFESSOR PERRY

A practical course intended to correct faults in delivery, establish sound standards of oratory, and train students in easy, effective oral expression. Constant class-room practice in informal debates and in other forms of public speaking. Open to students who have finished the required English courses.

3 hrs., first semester. 3 units.

22. Modern English Prose Style. PROFESSOR PERRY

A theme course based on the study of models. Open to college students who have successfully completed English 1 and 2.

3 hrs., second semester. 4 units. Not offered 1915-1916.

#### ENGLISH LITERATURE

- 3, 4. History of English Literature. PROFESSOR BATES

An outline of English Literature from its beginning down to the present time. Textbook, Moody and Lovett's *History of English Literature*. Assigned readings from numerous authors. This course is preliminary to all other courses in English literature.

2 hrs., both semesters. 2 units, each semester.

- 5, 6. Elizabethan Drama. PROFESSOR BATES

Development of the Elizabethan drama from the Miracle Plays, Moralities and Interludes; the Senecan influence, the work of Lyly, Greene, Peele, Kyd, and Marlowe; a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama. Lectures and discussions. A play is usually put on at Commencement by the members of this class.

3 hrs., both semesters. 3 units, each semester.

7. Nineteenth Century Literature. The Romantic Period.

PROFESSOR BATES

The historical development of the romantic spirit and its manifestation in the poetry of Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats, the essays of Lamb, Hazlitt, De Quincey, and Emerson, the fiction of Scott, Hawthorne, Poe, Charlotte Bronte and Emily Bronte.

5 hrs., first semester. 5 units.

8. Nineteenth Century Literature. The Victorian Period.

PROFESSOR BATES

The change of spirit in the Victorian era; the work of the typical Victorians: Tennyson, Macaulay, Dickens, Thackeray, and Eliot; the various forms of revolt in Arnold, Browning, Rossetti, Swinburne, Morris, Carlyle, Ruskin, Meredith, Hardy, and Stevenson.

5 hrs., second semester. 5 units.

- 9, 10. Principles of Literary Criticism. PROFESSOR BATES

A historical study of the chief theories of literary criticism to aid the student in forming satisfactory principles of judgment for himself. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The



second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics. Primarily for seniors.

2 hrs., both semesters. 2 units, each semester.

15, 16. Contemporary Literature. PROFESSOR BATES

Such a study of British and American literature in the last quarter-century as will enable the student to form a clear estimate of present-day tendencies: the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of Francis Thompson, Dowson, Symons, Henley, Yeats, and Hovey; in the prose of Kipling, Bennett, Wells, Grierson, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, Phillips, and Synge. Lectures, discussions and quizzes.

2 hrs., both semesters. 2 units, each semester.

17, 18. Chaucer. ASSISTANT PROFESSOR LUTRELL

A large part of the *Canterbury Tales* is read, the *Prologue of the Legende of Gode Wommen*, and some of the minor poems. A purely literary course; a knowledge of Anglo-Saxon is not required.

3 hrs., both semesters. 3 units, each semester.

FRENCH (SEE ROMANCE LANGUAGES)

GEOLOGY

PROFESSOR CLAPP

The courses in Geology, with the exception of 13 and 14 are intended for students in mining and applied geology. The advanced courses are offered primarily for those students who wish to take up geology as a profession, or who are engaged in geological research. They provide opportunities for study in the unexcelled geological field of Southern Arizona, which affords problems of great diversity in superficial, sedimentary, igneous and metamorphic rocks and in ore deposits, and where field work may be carried on at any time of the year.

1. 2. General Geology.

The fundamental principles of geology, preparing for the more detailed courses to follow. First semester, dynamical geology: the geological work of the atmosphere, surface and underground waters, of snow and ice, of earth movements, and of vulcanism. Lectures and

recitations, and the interpretation of topographical and geological maps in the laboratory. Second Semester, structural geology and the origin and classification of rocks, and briefly historical geology. Continued study of topographical and geological maps; structural problems; the field classification and macroscopic study of rocks, and the fundamentals of geological mapping; and short field trips in the vicinity of Tucson. Prerequisite, Chemistry 1 and 2 and Mineralogy 1, which may be taken simultaneously.

Two hours and one laboratory period both semesters; 3 units each semester.

### 3. 4. Economic Geology.

Mineral deposits, including both metallic and non-metallic products: the occurrence, geological features, origin and classification of type deposits, especially of those of North America. In the second term one laboratory period a week for the petrographic study of wall rocks and their alterations, and for the macroscopic, petrographic, and metallographic study of polished surfaces of ores. Prerequisite, Geology 1 and 2, and Mineralogy 4. Mineralogy 5 and 6 taken simultaneously.

3 lecture hours, first semester; 2 lecture hours and 1 laboratory period, second semester. 3 units each semester.

### 5. Field Geology. (Summer Work)

Six weeks of field geology, between the junior and senior years, to present the various methods of geological surveying, and to give considerable practice in those methods adaptable to the region where the survey is held. Topographical mapping by the plane table method, and detailed geological mapping with the plane table. Geological maps are prepared by the students, and material for laboratory study is collected. Geological reports are prepared and submitted for criticism during the first semester, and for final marking not later than the end of that semester. The student provides himself with his equipment and pays his own expenses. Required in the course in Mining Engineering and Metallurgy.

Prerequisite, Geology 1 and 2. 6 units.

### 7. Introductory Paleontology.

The general principles of paleontology, and the structure, relationships, and geological significance of the principal types of fossil invertebrates and plants. No attempt is made to describe or identify

specific fossils, but instruction is given in methods of collecting fossils and of preparing them for identification by a trained paleontologist.

Prerequisite, Geology 1 and 2, or 13 and 14.

2 hours, first semester. 2 units.

9. 10. Advanced Economic Geology.

For graduate students in economic geology, especially for those who wish to work on one of the many varied problems in ore deposits afforded by the mining districts of Arizona. Each student selects his own problem, based either on the laboratory study of material on hand or preferably on material gathered by the student in the field. The work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

11, 12. Advanced Field Work.

For graduate students. Mapping an area in Arizona selected for the study of some particular problem in physiography, structural geology, petrology, or ore deposits. The problem selected is studied in detail, and the results presented in form for publication.

13. Dynamical Geology and Physiography.

For students in general arts and science, to familiarize them with the geological processes, erosion, transportation, sedimentation, deformation and eruption, and with the development and sculpturing of land forms. Lectures, illustrated by maps, diagrams, specimens, and stereopticon. Prerequisite, Entrance Chemistry.

2 hours, first semester. 2 units.

14. Historical Geology and Evolution.

A continuation of Geology 13. A general view of the past history and evolution of the earth and of its life as recorded by the sedimentary rocks and their enclosed fossils. Prerequisite, Geology 13.

2 hours, second semester. 2 units.

GERMAN

ASSISTANT PROFESSOR OTIS

1. 2. Elementary German.

First semester: Paul V. Bacon's German Grammar. Conversation based on Paul V. Bacon's *Im Vaterland*.

Second semester: German Grammar completed. Conversation

continued. Reading of Storm's *Immensee*; Gerstacker's *Germelshausen*.

5 hrs., each semester. 4 units each semester.

### 3. 4. Advanced German.

First semester; Paul V. Bacon's German Composition. Reading of Meyer-Foerster's *Karl-Heinrich*; Heine's poems and *Die Harzreise*.

Second semester: Pope's German Composition. Reading of Lessing's *Minna von Barnhelm*, Schiller's *Wilhelm Tell*, etc. Prerequisite, German 1-2.

5 hrs., each semester. 4 units each semester.

### 5. 6. Lessing, Goethe, and Schiller.

First semester: Life and works of Lessing. Reading Lessing's *Emilia Galotti*, *Nathan der Weise*. Life and works of Schiller. Reading of Schiller's *Die Jungfrau von Orleans*, *Maria Stuart*, *Wallenstein*.

Second semester: Life and works of Goethe. Reading of Goethe's *Hermann und Dorothea*, *Gotz von Berlichingen*, *Iphigenie auf Tauris*.

A brief outline of German Literature to the nineteenth century will be given. Prerequisite, German 3-4.

3 hrs., each semester; 3 units each semester.

### 5S. 6S. Reading and conversation in Scientific German.

First semester: Wallentin's *Grundzuge der Naturlehre*.

Second semester: Dippold's Scientific Reader. Prerequisite, German 3-4.

2 hrs., each semester; 2 units each semester.

### 7. 8. German Literature in the Nineteenth Century.

First semester: The Romanticists and their successors. Reading of works of Kleist and Grillparzer.

Second semester: The rise of Naturalism and Symbolism. Readings of works of Wildenbruch, Fulda, Sudermann, and Hauptmann. Prerequisite, German 3-4.

2 hrs., each semester. 2 units each semester.

### 9. 10. Methods, theory, and practice of teaching German.

Members will be required to observe methods used in teaching German. Reports and discussions on these observations. Lectures to de-

velop ideas of teaching German especially in secondary schools. Pre-requisite, German 5-6 or may be taken with German 5-6.

1 hr. each semester. 1 unit each semester.

11. 12. Goethe's *Faust*.

First semester: a close study of Goethe's life, and of Goethe's *Faust*, Part 1. Text, Goethe's *Faust* edited by Calvin Thomas, Part 1.

Second semester: Goethe's *Faust*, Part II. Text: Goethe's *Faust* edited by Calvin Thomas, Part II. Prerequisite German 5-6.

2 hrs., each semester. 2 units each semester.

GREEK

ASSISTANT PROFESSOR NEWSOM

1, 2. Beginner's Course.

White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books).

4 hrs., both semesters. 4 units, each semester.

3, 4. Homer, Plato, and Lysias.

Homer, *Iliad* (first four books); Plato, *Apology* and *Crito*; and selections from Lysias.

4 hrs., both semesters. 4 units, each semester.

HISTORY

PROFESSOR CHANDLER AND MR. HUBBARD

1, 2. Expansion of the American People. PROFESSOR CHANDLER

The political, social and economic development and expansion of the American people from the settlement of the Atlantic seaboard to the recent political and social activities in the far West; the adaptation of European peoples and institutions to American conditions; the industrial evolution; the early westward movement; the public domain; the development of western democracy; the social and economic changes following the Civil War; the settlement of the far West. Open to all College students.

3 hrs., both semesters. 6 units.

5, 6. Nineteenth Century Europe.

MR. HUBBARD

The liberal and reform movements of Europe during the last century; the evolution of constitutional government; various movements toward national unity; the rise of modern Italy; the Franco-Prussian



war; the rise of modern Germany; English reform bills of 1832, 1867, and other political developments.

3 hrs., each semester. 6 units.

7, 8. Constitutional History of the United States.

PROFESSOR CHANDLER

The formation of the Union and of the political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents and special histories.

3 hrs., both semesters. 6 units.

11. Development of the English Nation.

MR. HUBBARD

The English people from the earliest times to the end of the Tudor period. The influence of Church and Continental relations; the causes and events relative to the development of English social and political institutions. The student is expected to have a clear idea of the Constitution as developed to the close of the period.

3 hrs., first semester. 3 units.

12. Development of English Party Government.

MR. HUBBARD

Beginning with the close of the Tudor period, a study of the events and legislation causing and directing the growth of English political parties. The prerogatives of the crown, the development of the cabinet system, elections, methods of legislation, and the reform bills of the nineteenth century.

3 hrs., second semester. 3 units.

13, 14. Modern Europe.

MR. HUBBARD

European history from the close of the Reformation to the Napoleonic period. European civilization of the seventeenth and eighteenth centuries. Second semester: an intensive study of the French Revolution.

3 hrs., each semester. 6 units.

HOME ECONOMICS

MISS THOMAS

1. Elementary Food Preparation.

A study of food materials with reference to their composition, nutritive value and cost; the fundamental cooking processes and their effect upon the various foods; the proper combinations of foods and the serving of simple meals.

Demonstration lectures and laboratory work. 1 hour a week; 1 laboratory period of 2 hours, both semesters. 6 units

Prerequisite or parallel inorganic chemistry.

2. Advanced Cookery.

Practice in cooking, care of the kitchen, dining room and serving of meals; diet for invalids and infants.

Lectures and laboratory work. Two periods a week,  $2\frac{1}{2}$  hours each, first semester. 3 units.

3. Home Cookery and Table Service.

Practice in home cookery. Each student will plan, cook and serve—a breakfast, dinner, luncheon and supper; each student also gives one or two demonstrations before her classmates. For students who expect to teach or take charge of families where such work is done.

Three laboratory periods a week, three hours each, second semester. 3 units.

4. Home Nursing and Emergencies.

Simple emergencies and first aid to the injured and simple procedures in home care of the sick: bleeding, wounds, fractures, sprains, fainting, convulsions, shock, asphyxiation and poisoning, caring for sick when professional services of a nurse are not required. Prerequisite, Zoology 4.

1 period a week,  $2\frac{1}{2}$  hours, first semester. 2 units.

5. Dietetics.

A study of balanced diet; the nature of foods; planning of menus for children and adults under normal conditions. Open to seniors.

2 periods a week, 2 hours each, first semester. 2 units.

6. Elementary Clothing and Handwork.

The use of the sewing machine and its attachments; the making of simple garments by hand and machine; darning, patching and simple embroidery.

2 laboratory periods a week,  $2\frac{1}{2}$  hours each, two semesters. 6 units.

7. Textiles A and B.

PROFESSOR MESERVE

A: The identification of fibres and substitute materials by means of the microscope and chemical tests.

B: A study of textile industries from primitive times to the present day; the methods of cording; warping and weaving, the culture of the fibres and their uses. Lectures, reading and reports.

Second semester. 3 units.

### 8. Drafting, Draping and Pattern Making.

Practice in drafting, cutting, fitting and designing patterns—a few simple garments are made.

2 periods a week, 2½ hours each, second semester. 3 units.

### 9. Dressmaking.

The making of simple dresses, waists and trimmings.

2 periods a week, 2½ hours each, first semester. 3 units.

### 10. Chemistry of Foods.

PROFESSOR MESERVE

Preparation of the various staple foods from the raw state to the finished product in market: a discussion of the composition and cost of materials—cereals, flours, meals, starch, bread, sugars and condiments; drying, salting, smoking, curing and preserving; adulteration and substitution. Prerequisite, (inorganic) and (organic) chemistry.

2 periods, 2 hours each, second semester. 2 units.

### 11. Theory and Practice of Teaching Home Economics.

Methods of teaching, courses of study, equipment of laboratories and such problems as are likely to confront teachers. Prerequisite, all technical work and psychology. Parallel, History of Education.

2 periods a week, 2 hours each, second semester. 2 units.

### 12. Cookery for Homemakers.

For Tucson ladies who may care to take such work and for students as a free elective. The study of breads, meats, vegetables, desserts and salads. A few lessons will be given on table service. Several meals will be prepared and served by the class. One semester.

### 13. Textiles and Sewing for Homemakers.

For the same class of students as Cookery 12 and is open to town ladies. Simple garments, underwear or children's clothes. A few simple embroidery stitches will be taught and applied to garments. One semester.

### 14. Millinery.

The making of hats, and the renovation of old materials, the manufacture of artificial flowers and other trimmings.

2 periods a week, 2½ hours each, second semester. 3 units.

### LATIN

ASSISTANT PROFESSOR NEWSOM

The courses below are open to students who have completed the

first three years of Latin in the sub-collegiate department, or an equivalent.

1, 2. Livy and Cicero.

Livy, *Selections*; Cicero, *de Senectute, de Amicitia*. Exercise in prose composition.

4 hrs., both semesters. 4 units, each semester.

3, 4. Tacitus and Horace.

Tacitus, *Germania* and *Agricola*; Horace, *Odes* and selections from *Epodes*.

3 hrs., both semesters. 3 units, each semester.

5, 6. Cicero, Horace and Tacitus.

Cicero, *Letters*; Horace, *Letters*; Tacitus, selections from *Histories*.

3 hrs., both semesters. 3 units, each semester.

#### MATHEMATICS

ASSOCIATE PROFESSOR DINES, ASSISTANT PROFESSOR MEDCRAFT

1a. College Algebra. PROFESSORS DINES AND MEDCRAFT  
Prescribed for all engineering courses.

3 hrs., first semester. 3 units.

1b. Trigonometry. ASSISTANT PROFESSOR MEDCRAFT  
Fundamental formulas of plane trigonometry with applications to surveying. Prescribed for all engineering courses.

3 hrs., first semester. 3 units.

Students having had trigonometry may obtain college credit for the subject by passing a satisfactory examination, provided the same work has not been used for entrance.

2. Analytical Geometry. PROFESSORS DINES AND MEDCRAFT  
The fundamental methods of the subject. Prescribed for all engineering courses.

5 hrs., and a 2-hr. laboratory period, second semester. 6 units.

9. Algebra and Trigonometry. ASSOCIATE PROFESSOR DINES  
A briefer course than 1a and 1b, for those desiring a minimum amount of mathematics. Required of all candidates for the B. S. degree who do not elect 1a and 1b.

4 hrs., first semester. 4 units.

10. Elementary Analysis. ASSOCIATE PROFESSOR DINES

A brief course in Analytic Geometry and Calculus. The aim of this course is to give a simple and direct introduction to those portions of mathematics beyond Trigonometry which are of most importance to the student of science, and of most interest to the general student. Required of all candidates for B. S. degree who do not elect Mathematics 2.

4 hrs., second semester. 4 units.

2a. Advanced Algebra. ASSISTANT PROFESSOR MEDCRAFT

Continuation of Mathematics 1a.

2 hrs., second semester. 2 units.

2b. Spherical Trigonometry. ASSISTANT PROFESSOR MEDCRAFT

Fundamental formulas and principles of the spherical trigonometry, with applications to astronomy. Prerequisite—Mathematics 1b.

2 hrs., second semester. 2 units.

3. Differential Calculus. ASSISTANT PROFESSOR MEDCRAFT

Fundamental principles and formulae of the differential calculus, with their application. Prescribed for sophomores in engineering courses.

4 hrs., first semester. 4 units.

4. Integral Calculus. ASSISTANT PROFESSOR MEDCRAFT

The fundamental principles and formulas of the integral calculus with their applications; including the use of tables of integrals. Prescribed for all engineering courses. Prerequisite, Math. 3.

4 hrs., second semester. 4 units.

4a. Advanced Calculus. ASSOCIATE PROFESSOR DINES

A supplementary course to Mathematics 3 and 4, giving special attention to special methods and applications to geometry, physics, mechanics, and other allied subjects.

2 hrs., second semester. 2 units.

5. 6. Analytical Mechanics. ASSOCIATE PROFESSOR DINES

The mathematical treatment of the fundamental principles of dynamics, statics, etc. Prerequisites—Mathematics 3, 4. Prescribed for all engineering courses.

4 hrs. and a 2-hr. laboratory period for the first semester. 5 units.

4 hrs., second semester. 4 units.



## 5a. Differential Equations. ASSOCIATE PROFESSOR DINES

A course in elementary differential equations, with applications to physics, astronomy, mechanics, and engineering.

2 hrs., first semester. 2 units.

## 7. Higher Plane Curves. ASSISTANT PROFESSOR MEDCRAFT

A study of algebraic and transcendental curves, from the analytical and graphical standpoints.

First semester. 2 units.

## 8. Computation. ASSOCIATE PROFESSOR DINES

In this course will be given opportunity for the student to become familiar with many of the empirical and theoretical formulas of engineering, mathematics and physics.

Second semester. 2 units.

## 11. Synoptic Course in Advanced Mathematics.

ASSOCIATE PROFESSOR DINES

A brief survey of the development of the principal branches of mathematics, with reference to their historical and logical interrelation. Prerequisite—Mathematics 2.

3 hrs., first semester. 3 units.

## MECHANIC ARTS

PROFESSOR HENLEY, MR. HENDRY

## 1. Mechanical Drawing. PROFESSOR HENLEY

Elements of mechanical drawing, including lettering, tracing, and blue printing. The subject is treated in a purely mechanical way. Making and reading ordinary working drawings, and ordinary drafting room practice.

2, 3 or 4-hr. laboratory periods. One section each semester. 2, 3 or 4 units.

## 2. Descriptive Geometry. PROFESSOR HENLEY

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids.

1 lecture and 2 3-hr. laboratory periods. One section each semester. 3 units.

## 3. Wood Shop. MR. HENDRY

Bench and machine work; elements of pattern and foundry work.

2 3 hr. periods, with occasional lectures. One section each semester. 2 units.

## 4. Forge Shop.

MR. HENDRY

Forge work in iron and steel; tempering, case-hardening and annealing; characteristics of iron and steel which affect their working in the shop.

2 3-hr. periods, with occasional lectures. One section each semester. 2 units.

## 5, 6. Machine Shop.

MR. HENDRY

Elements of machine shop practice, and erection and care of machinery; work on the drill press, shaper, lathe, and planer, as well as at the bench, and on the erecting floor. Only ordinary work is taken up, the object being to make this a general engineering course. Open to students who have had courses 1, 3, 4 or an equivalent.

## 8. Carpentry.

MR. HENDRY

Wood work, including framing, joining, care of tools, etc.

2 3-hr. periods, second semester. 2 units.

## 9. Forge and Metal Work.

MR. HENDRY

Forge work in iron and steel, pipe, work, drill press, and care of small machinery.

2 3-hr. periods, first semester. 2 units.

## 11. Lettering.

PROFESSOR HENLEY

Types of letters used for drawings and notes in various branches of work.

1 or 2 3-hr. periods, either semester. 1 or 2 units.

## MECHANICAL ENGINEERING

## PROFESSORS HENLEY AND ALDRICH

## 1, 2. Mechanisms and Elements of Machine Design.

PROFESSOR HENLEY OR ALDRICH

Theory and design of linkages, gears, cams, screws, and other machine elements.

2 3-hr. periods, both semesters. 2 units, each semester.

## 3. Heat Engines.

PROFESSOR HENLEY OR ALDRICH

Principles of thermodynamics as applied to steam and internal combustion engines. Testing and operation, steam and gas engines, boilers.

2 hrs. and 1 3-hr. laboratory period, first semester. 3 units.

4. Pumping Machinery. PROFESSOR HENLEY OR ALDRICH

Various types of pumps and compressors, and their efficiencies under different conditions.

2 hrs. and 1 3-hr. laboratory period, second semester. 3 units.

5, 6. Machine Design. PROFESSOR HENLEY OR ALDRICH

Design, largely empirical, of various tools or machine parts.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

7, 8. Mechanical Laboratory. PROFESSOR HENLEY OR ALDRICH

Testing of different types of engines, boilers, pumps, injectors and other machinery. Inspection of power plants and machinery installations.

2 3-hr. laboratory periods and 1 3-hr. computation period, both semesters. 3 units, each semester.

9, 10. Engine Design. PROFESSOR HENLEY OR ALDRICH

Design of the main features of a steam or gas engine, pump or compressor, with the completion of as much of the working details as time permits.

2 3-hr. drafting periods, both semesters. 2 units, each semester.

12. Power Plants. PROFESSOR HENLEY OR ALDRICH

The economic design and operation of power and pumping plants. Problems involving the selection of machinery to perform a given duty with a probable minimum expense.

2 hrs., second semester. 2 units.

14. Small Power Plants and Pumping Machinery.

PROFESSOR HENLEY

An abridged course in small machinery installations, problems encountered in ordinary small pumping plants. A non-technical course for students in agriculture.

2 hrs. and 1 3-hr. elective laboratory period, second semester. 3 units.

16. Seminar. PROFESSORS HENLEY AND ALDRICH, MR. SNOW

Discussion of various subjects that arise in connection with the work of the department and the review of current engineering literature.

1 hr., second semester. 1 unit.

## METALLURGY

## PROFESSOR GOODRICH

## 1. Introduction to Metallurgy.

Physical properties of metals, alloys, thermal treatment of metals, thermal measurements, fuel, refractory materials, metallurgical processes, furnaces, thermo-chemistry, metallurgy of iron and steel.

Lectures, 1 hr., first semester. 1 unit.

## 2. Fire Assaying.

Fire assay for gold, silver and lead. Bullion assays. Prerequisite, Chemistry 3, 4.

Three 3-hr. laboratory periods, second semester. (March, April, May.) 2 units.

## 3. Metallurgy of Gold and Silver.

Stamp milling, chlorination, tube-milling, and filtering, cyaniding, pan-amalgamation; Patio, and Tina processes; hyposulphite leaching practice, etc. Lectures. Prerequisites, Metallurgy 1, 2, 7.

3 hrs., first semester. 3 units.

## 4. Metallurgy of Lead and Copper.

Sampling, receiving, purchasing, roasting; blast furnace methods, reverberatory furnace methods; pyritic smelting, converting, desilveration of base bullion, electrolytic refining, hydro-metallurgy of copper, etc. Lectures. Prerequisites, Metallurgy 1, 2, 7.

4 hrs., second semester. 4 units.

## 5a. Metallurgical Laboratory.

Amalgamation, cyaniding, chlorination, hyposulphite lixiviation, etc., tests, together with mill work. This course runs parallel with Metallurgy 3. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

## 5b. Metallurgical Laboratory.

Sampling, concentration, mill work. This course runs parallel with Metallurgy 7. Lectures.

1 3-hr. laboratory period, first semester. 1 unit.

## 6. Metallurgical Laboratory Thesis Work.

Original problems in the treatment of ores, experiments to determine the best method of treatment. The equipment now is as com-

plete as in some of the best commercial ore testing plants, and new machinery is constantly being added.

2 3-hr. laboratory periods, second semester. Time to be arranged. 2 units.

#### 7. Ore Dressing.

Breaking, crushing, separating, concentrating, sampling; mill processes and management. Lectures and recitations. Prerequisite, Metallurgy 2.

3 hrs., first semester. 3 units.

#### 8. Metallurgy of Rare Metals.

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, molybdenum. Lectures. Prerequisites, Metallurgy 1, 2 and 3.

2 hrs., second semester. 2 units.

#### 9. Excursions.

On the completion of the various subjects, trips will be taken to suitable plants, in order to study practically the metallurgical operations. The student thus is enabled to reap the advantage of our location—central in a great metallurgical field.

#### 10. Concentrator and Smelter Design.

A practical metallurgical problem, such as may confront the student on entering practical work. The student may design the plant to suit the ore tested in Met. 6 Course.

3 hrs., or an equivalent, second semester. 3 units.

### MILITARY SCIENCE AND TACTICS

PROFESSORS BROWN AND MESERVE, MESSRS. BREWER AND CULIN.

#### 1, 2, 3, 4. Military Tactics.

This work is required of all male students throughout the preparatory course and four semesters of college work. The practical work consists of drill for three periods a week, one hour each—for the time above indicated. The theoretical work consists of recitations, once a week—for the time indicated, and covers the school of the soldier; the school of the squad; school of the battalion, close and extended order; ceremonies, battle exercises and target practice, bayonet exercise and fencing. Text-books: U. S. Drill Regulations, Manual of Guard Duty, Outlines of First Aid for the Hospital Corps, Manual of Small Arms Firing Regulations, and Manual of Bayonet Exercise and Fencing.

One unit, each semester.



NOTE—Under a new rule of the University requiring all students to take four semesters of tactics, no compensation will be allowed students for military duty performed during that period. The compensation heretofore allowed officers will be given only upon the recommendation of the head of the military department, to such students of the junior and senior classes as may volunteer for or elect to take the higher work in the military department and act as officers and assistant instructors in the department, on the same basis as students act in similar capacity in other departments of University work.

5, 6, 7, 8. Military Science.

Each course is pursued for one semester, 2 hours a week, and the ground covered by all four courses, in four semesters, includes elementary law, elementary international law, military law, ordnance and gunnery, military engineering, the art of war, battles and campaigns.

2 hrs., each semester. 2 units.

#### MILITARY STAFF

Superintendent and Professor of Military Science and Tactics—Col. George LeRoy Brown, U. S. Army.

Quartermaster and Acting Adjutant—Capt. Charles F. Willis, N. G. A.

Instructors in Rifle Practice—Cadet Major, L. R. Jackson, Cadet Capt. V. G. LaTourrette.

Ordnance Sergeant—Dudley S. Brown.

Department of Tactics—Lieut. Colonel Charles A. Meserve, N. G. A. Commandant of Cadets and Instructor of Tactics—Cadet Major Walter H. Brewer, Assistant Instructor of Tactics—Cadet Major Frank J. Culin.

#### CORPS ORGANIZATION

Adjutant Cadet, 1st Lieutenant, J. W. Getsinger

Quartermaster Cadet 2nd Lieutenant, Marcus T. Kendall

Sergeant Major, Frank J. Hobson

Color Sergeant, Charles P. Beach

Color Sergeant, Turner C. Smith

COMPANY A	COMPANY B	COMPANY C
Geo. W. Scheerer	J. Preston Jones	Sam Caruthers
	FIRST LIEUTENANTS	
Leo. F. Cloud	Francis Mack	R. G. Lindsley
	SECOND LIEUTENANTS	
W. W. Pickrell	M. M. Piper	Marcus T. Kendall
	FIRST SERGEANTS	
H. H. Grimshaw	Carl W. Clark	Ralph L. Bell
	SERGEANTS	
A. Mayhew	Allan C. Jones	J. A. Hedgepeth
	C. Z. Leshner	Dudley S. Brown
	CORPORALS	
Edgar Rogers	W. L. Fickett	L. L. Kriegbaum
Charles Lawton	F. G. McClure	J. W. Voller
William Steinegger	A. Condron	Herbert Wood
	BAND	
Band Leader, A. E. Clark	Sergeant, Alma Sessions	
Drum Major, Frank J. Hobson	Corporal, Prentice W. Dill	
1st Sergeant, Geo. A. Clawson	Corporal, Ralph Reynolds	

## MINERALOGY

## PROFESSOR GUILD

1. Determinative Mineralogy and Blow-Pipe Analysis.

PROFESSOR GUILD AND MR. MINISTER

Laboratory work with occasional recitations. Textbook: Lewis, *Determinative Mineralogy*. Prerequisite, Chemistry 2.

Two 3-hr. laboratory periods, first semester. 2 units.

3. Elementary Crystallography.

Two lectures or recitations per week. Prerequisite, Physics 2. 2 units.

4. Descriptive Mineralogy.

Lectures and recitations on the mode of occurrence, uses and classification of minerals. Study of a large number of hand specimens of minerals. Textbook: Dana, *A Text-book of Mineralogy*. Prerequisites, Geology 1, Mineralogy 1 and 3.

3 lectures, second semester. 3 units.

### 5. Optical Mineralogy.

The microscopic study of the rock-forming minerals. Prerequisites, Geology 2, and Mineralogy 4.

2 hrs., or an equivalent, first semester. 2 units.

### 6. Petrography.

Preparations of thin sections of rocks for microscopic study, and study of a type selection of rocks. Prerequisite, Mineralogy 5.

2 hrs., or an equivalent, second semester. 2 units.

### 7. Crystallography.

Measurement, projection and drawing of crystals. Prerequisite, Mineralogy 3.

Either semester. 2 or 4 units.

## MINING ENGINEERING

### ASSISTANT PROFESSOR WILLIS

### 8. Elements of Mining.

The science of mining and a brief but concise summary of all methods of mining. Placer mining, open cut mining, quarrying, coal mining and underground mining; history and importance of the industry and the principal ore mines.

2 hrs., second semester. 2 units.

### 1, 2. Mining Machinery.

Machinery in its application to mining, taking up in detail: churn and diamond drills, hand and machine tools for excavation, air compression, rock drills, electric drills, tunneling machines, explosives and blasting, hydraulicking machinery, coal mining machinery, methods of haulage including aerial tramways, hoisting machinery, drainage and pumping machinery, ventilation and illumination. Surface plants, including shops, ore bins, head frames, rock houses, breakers.

2 hrs., each semester. 2 units, each semester.

### 3, 4. Mining Laboratory.

Practical underground mining in the University underground laboratories: use and care of underground machinery, methods of mining, shaft sinking, tunneling, use and handling of explosives, timbering methods, steel sharpening, and the varied other problems of actual underground operation.

One 3-hr. laboratory period each semester. 1 unit, each semester.

### 3a, 4a. Mining Laboratory.

Similar to Mining Laboratory 3 and 4, covering the subject more thoroughly. This may be offered as a substitute for Mining Engineering 7, practical summer mining.

One 3-hr. laboratory period each semester. 1 unit, each semester.  
5, 6, or Economics 21, 22. Principles and Economics of Mining.

#### PROFESSORS WILLIS AND CHANDLER

A detailed study of the business of mining. Mine examinations, sampling, reports, valuation of mines, considerations preceding the opening of mines, organization, incorporation, financing, mine promotion, stockholders rights, mining investments, frauds, mine administration, leasing, ore contracts, costs of operations, cost accounting with reference to mines especially, analysis of costs, administrative reports, statistics, royalties, influence of transportation facilities, development of mines, factors governing methods, underground methods, safety costs, mechanical equipment, efficiency, power conditions, surface handling, ore sorting, freight contracts, smelter contracts, labor problems, systems of handling, labor unions, mine accidents, laws regulating, social condition of workmen, mining law of United States and Arizona.

3 hrs., each semester. 3 units, each semester.

### 7. Practical Mining.

Before entering upon the work of the senior year, all students who are candidates for the degree of B. S., in Mining Engineering and Metallurgy, must have spent at least six weeks in practical underground mining or in practical metallurgical work. The fulfillment of this requirement must be evidenced by the certificate of the superintendent or foreman, and by notes and sketches of the processes observed, and a report of such work must be made before November 1st of the same year. Two units credit are given upon the report with original notes and sketches attached.

### 9. Field Excursions.

In connection with the courses in Mining Engineering and Metallurgy, trips are made to mining districts in Arizona and Sonora, usually one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering and Metallurgy.

These trips afford the student close study and inspection of mining and metallurgical plants, and of rock formations and of minerals of

commercial value. The students are accompanied by members of the faculty, and effort is made to make the trips of the greatest practical value. The trips are carefully scheduled; notes, with sketches, measurements and photographs are taken, and elaborated into comprehensive reports by each student after the return.

NOTE—All students in mining engineering in the senior year are required to give one hour a week in seminar, for the discussion of current technical literature in mining, for which work no credit is given.

#### PHILOSOPHY AND EDUCATION

#### 1, 2. History of Philosophy. PROFESSOR BATES

Basal concepts and fundamental problems of philosophical thought as developed historically. Lectures, recitations and assigned readings. Textbooks: Schwegler's *History of Philosophy*; Calkins, *The Persistent Problems of Philosophy*. Open to Juniors and Seniors.

3 hrs., both semesters. 3 units, each semester.

#### 3. Psychology.

A special consideration of the subject as applied to teaching. Lectures, recitations and collateral reading. To be taken in the Sophomore year. Text: Angell's *Psychology*.

#### 4. Pedagogy. PRESIDENT WILDE

Educational evolution, both as a culture fact in the history of civilization and as a foundation for professional work; lectures, giving a brief but comprehensive outline of school systems, a special study of leading educators such as Comenius, Pestalozzi, Froebel, Mann, and others. Arrangements have been made with the Tucson city schools to provide practice work for this class. Open to students who have taken Philosophy 1.

2 hrs., both semesters. 2 units, each semester.

Graduates of the University who fulfill the requirements of the State Board of Education for teacher's certificate are awarded a first grade state certificate, valid for four years, on application at the end of the college course. Among the electives of the college course the young man or woman who desires to teach should include courses in Psychology, History of Education and School Management. This matter is intended to be covered in Philosophy 3 and 4.

#### PHYSICAL TRAINING

NOTE.—By action of the faculty taken after earlier pages of this catalog were printed, gymnasium is no longer a fixed requirement for



men students. Any young man may request the Director of Athletics for a physical examination and for the prescription of gymnasium exercises to correct detected physical defects. If there is a suitable number requesting the work, the University may, at its option, provide a men's class in the gymnasium, at stated hours, but no University credit will be assigned to it.

The requirement of physical training for women remains the same as indicated below.

#### PHYSICAL TRAINING FOR WOMEN

This department aims to cultivate the greatest efficiency of the human body, to make it the alert, perfectly balanced servant of the mind. As one of the prime factors in such a condition, correct posture and good walking habits are constantly demanded, special training being given to insure these two results. Believing that the exclusive use of any games or sports, such as tennis, basket-ball, or dancing, does not give the drill in proper posture, each pupil is required to take at least one hour a week for work in the gymnasium, although she may substitute tennis for the other two hours. In the spring, the women of the University join in producing a festival dance,—exhibiting publicly the results of the year in Physical Training.

##### Physical Training I.

MISS CHAPIN

Required of all first year students. Elementary Swedish gymnastics, breathing exercises, simple folk-dances,—emphasis constantly on improvement in standing and walking.

Three times a week. 1 unit.

##### Physical Training II.

MISS CHAPIN

Prerequisite, Physical Training I. A course in dancing. Exercises to develop coordination of arms with the other muscles of the body. Constant exercises in breathing. The study of typical dances of various nations, and an attempt to make the student use the dance as a fine form of exercise for all the muscles of the body, as well as a delightful form of expression.

Three times a week. 1 unit.

##### Physical Training III.

MISS CHAPIN

No prerequisite. All young women in the University may attend. A recreation course, consisting first of simple Swedish movements, of easy folk-dances,—and then some of the best social dances of ancient and modern times. An effort is made to develop an intelligent atti-

tude toward dancing, and to improve the standards of social dancing by comparing the dances of various centuries, and analyzing the elements which makes them desirable, enjoyable and beautiful types of diversion.

One hour a week.

#### ATHLETICS.

The climate of Tucson permits athletics out of doors throughout the academic year. The main out-door sports are football, baseball, tennis, and track work. Every student is encouraged to undertake some form of athletics, and exercise, as in the gymnasium, is graduated to the physical needs and the endurance of the student.

Team work is provided to add interest to the sport. There is an unusually large percentage of students engaged in athletics. Remoteness from other colleges prevents excessive interest in intercollegiate contests and gives occasion for inter-class games. Competitive athletics are pursued with the schools, colleges and universities of Arizona, New Mexico, and southern California.

#### PHYSICS

##### PROFESSOR DOUGLASS

##### 1, 2. General Physics.

PROFESSOR DOUGLASS

Lectures, recitations and laboratory work. First semester: Mechanics and heat. Second semester: Electricity, wave motion, sound and light. The laboratory experiments give prominence to general electrical measurements, but include the study of wave motions and their application to the other subjects. Prerequisites: A course in elementary physics and Mathematics 1.

2 hrs., and two 2-hr. periods in the laboratory, both semesters. 4 units each semester.

##### 3. Thermodynamics and Heat.

PROFESSOR DOUGLASS

The foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. Prescribed for third year in mechanical engineering course.

1 hr. and two 3-hr. periods, first semester. 3 units.

##### 4. Electrical and Optical Measurements. PROFESSOR DOUGLASS

Electrical machines and instruments used in mechanical engineering, and optical instruments handled in mining and civil engineering

courses. Prescribed for the third year in mechanical and civil engineering courses.

1 hr. and two 3-hr. periods, second semester. 3 units.

ROMANCE LANGUAGES

PROFESSOR TURRELL AND MISS POST

French

1, 2. Elementary French. MISS POST

First semester: Fraser and Squair, *French Grammar*, (Part I), Aldrich and Foster, *French Reader*. Second semester: Reading of Labiche and Martin, *La Poudre aux Yeux*; Halévy, *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs.

5 hrs., both semesters. 4 units, each semester.

3, 4. Advanced French. PROFESSOR TURRELL

First semester: Fraser and Squair, *French Grammar*, (Part II), Merimeé, *Colomba* or *Carmen*; Lamartine, *Graziella*; Sand, *La Mare au Diable* or *La Petite Fadette*. Second semester: Selected reading: including Victor Hugo, *Les Misérables* (abridged); Balzac, *Eugénie Grandet*; Zola, *La Débâcle*, etc.

5 hrs., both semesters. 4 units, each semester.

5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists: plays of Corneille, Racine and Moliere. Lectures on the eighteenth century: Voltaire, Rousseau, Diderot, and other writers. Beaumarchais, *Le Barbier de Seville*. Library readings.

6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier. Recent literary movements in France. Paileron, Dumas, Rostand, Zola, Sardou, Hervieu, Maeterlinck, and others.

3 hrs., second semester. 3 units.

7, 8. Advanced Composition and Conversation. PROFESSOR TURRELL

Vreeland and Koren, *French Syntax and Composition*; Kron *French Daily Life*, etc. Original essays and reports in French.

2 hrs., both semesters. 2 units, each semester.

Courses 5, 6, 7, 8 may be taken together or separately, but must be preceded by courses 1, 2, 3, 4.

## Spanish

## 1, 2. Elementary Spanish.

Miss Post

First semester, Coester, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Conversation and oral work. Second semester; Grammar and reader completed; additional readings with composition and dictation.

5 hrs., both semesters. 4 units, each semester.

1a, 2a. Elementary Spanish. *Evening Course*.

Miss Post

Covering the work of Spanish 1, (1st semester of first year) emphasizing as far as possible conversation and oral work. May not be taken by regular students as a substitute for Spanish 1, except by special permission. Tuesday and Thursday evenings at 7:30.

2 hrs., both semesters. 2 units, each semester.

## 3, 4. Advanced Spanish.

Miss Post

First semester: Reading of Johnson, *Cuentos Modernos*; Alarcón, *El Capitán Veneno*. Second semester: Galdós, *Marianela*; Valdés, *La Alegría del Capitán Ribot*, etc. Three hours each week in the first semester and two hours in the second are given to composition, letter writing and syntax, using Umphrey, *Spanish Composition*, etc.

5 hrs., both semesters. 4 units, each semester.

## 5. Spanish Literature to the Nineteenth Century.

PROFESSOR TURRELL

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don Quijote* (Selections); Lope de Vega, *La Estrella de Sevilla*; Calderón, *La Vida es Sueño*, etc.

3 hrs., first semester. 3 units.

## 6. Spanish Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. Reading of Moratín, *El Sí de las Niñas*; Larra, *Partir á tiempo*; Guitérrez, *El Trovador*; Tomayo y Baús, *Lo Positivo*; Nuñez de Arce, *El Haz de Leña*; Echegaray, *El Gran Galeoto*; Galdós, *Electra*.

3 hrs., second semester. 3 units.

## 7, 8. History of Mexican Literature.

PROFESSOR TURRELL

Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc.

2 hrs., both semesters. 2 units, each semester

## 9, 10. Advanced Spanish Composition and Commercial Spanish.

PROFESSOR TURRELL

A practical course in writing and speaking Spanish. Harrison, *Spanish Correspondence*; Remy, *Spanish Composition*; Bonilla, *Spanish Daily Life*, will be used. (May be taken with courses 5, 6, but must be preceded by courses 1, 2, 3, 4.)

2 hrs., both semesters. 2 units, each semester.

## 11. Scientific and Technical Spanish.

PROFESSOR TURRELL

Especially for scientific and engineering students. Willcox, *Scientific and Technical Spanish*. Study of vocabulary of mining, bridge-building, steam engines, electricity, etc. Prerequisite Spanish 1, 2, 3, 4, or at least two years of high school Spanish.

## Romance Languages

1. Methods of Teaching Romance Languages,—*French*.

PROFESSOR TURRELL

Study and comparison of various grammars and texts, with particular reference to the needs of high schools and to College entrance requirements.

1 hr., first semester. 1 unit.

2. Methods of Teaching Romance Languages,—*Spanish*.

PROFESSOR TURRELL

Similar to Course 1, but emphasizing Spanish, and particularly the adaptation of various methods to the teaching of the language in Arizona and the Southwest.

1 hr., second semester. 1 unit.

3, 4. Contemporary Drama.—*Evening Course*.

PROFESSOR TURRELL

Discussion in English of contemporary French and Spanish drama: selections from the current plays of writers such as Maeterlinck, Rostand, Bernstein, Brieux, Flers and Caillavet, Kistermaecker, etc., in French, and Galdós, Benavente, Martinez Sierra, Marquina, the Quinteros, etc., in Spanish. Knowledge of French or Spanish is not necessary, but will be helpful. The aim will be to acquaint those interested in the drama with the best work that is being done in France and Spain at the present time. Open to all students and to the public. Wednesday evening at 7:30.

1 hr., both semesters. 1 unit each semester.



ZOOLOGY  
MR. BROWN

1. Invertebrate Zoology.

Development and anatomy of types of the various phyla of invertebrates. Text: Hegner, College Zoology.

2 hrs. of lectures and 6 hrs. of laboratory work, first semester.  
4 units.

2. Vertebrate Zoology.

A continuation of course 1.

4 units.

3. Histology of the Animal Tissues.

The theory and use of the microscope, the camera lucida, the photomicrographic camera, the use of chemicals in the preparation of microscope slides. Primarily a laboratory course.

4. Physiology.

The blood, respiration, secretion, and absorption. The experiments performed are those used in the first year of physiological work in the medical schools. For college students desiring information regarding the structure and functions of their own bodies, and for those students who are intending to enter a medical school. First semester.

4 units.

5. Physiology.

A continuation of course 4, so arranged that new students may begin physiology with this course. Study of the circulation and of the nervous system takes the larger part of the semester. Second semester.

4 units.

EXTENSION LECTURES

In the current year the University has operated a system of extension lectures under an appropriation made by the legislature. The University responds to requests for lectures in various fields of its work, giving these lectures without cost to the community for service or transportation. Whenever possible, the community provides the entertainment of the speaker.

Correspondence regarding these lectures or for any work on the extension system should be addressed to the office of the President of the University. Ample time should be allowed for the appointment of dates and for the adjustment of all details of the lectures, especially that the dates requested may accord with appointments elsewhere; the University desires that whenever possible three to four weeks' notice be given.

## BUREAU OF MINES

A Bureau of Mines has been established in connection with the Mining Department to deal with the mining, smelting and geological problems of the state. The present price of metals and the consequent activity in mining create the need for a bureau for gathering, correlating and working on the engineering problems of the state.

The Bureau compiles and publishes statistics of all kinds regarding Arizona mines, such as production, values, types of machinery, efficiency reports, methods, mill statistics and other data of interest and importance to every operator of this state, as well as of other states. A bibliography and library of all literature pertaining to Arizona mining and geology are of obvious utility.

It is aimed to deal experimentally with Arizona problems of wet, dry and electrostatic concentration, dry placer and flotation methods. The cooperation of the mining machinery companies has equipped our laboratories for such work during the past year by donations of machinery to the value of about \$12,000.

The Bureau aims to educate the miner and prospector, by series of lectures, articles in daily and weekly mining papers, and publication of items of interest. The employer, as well as the miner, should profit by this educational work. The Bureau will offer to the miner and prospector a place for determining samples; practical advice and instruction, and education on the economic side; an office of exchange and information. The same data will be of service to those outside the state who desire information on Arizona mining.

Assays of ores and minerals are made for prospectors and miners of Arizona and for others at fixed rates, established by law and tabulated below. Accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate and if not accordant, are repeated. The money received for assaying is deposited monthly to the credit of the Assay fund, which is used to pay the assayer and the cost of material and apparatus.

## RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS

## Common Assays and Chemical Determinations

In accordance with the Act of the Legislature of Arizona, approved March 1897, and amended in March, 1899.

One element only:

Gold, or silver, or copper, or lead, or iron, or insoluble .....	1.00
Zinc, or calcium, or magnesium, or sulphur, or manganese .....	1.50
Silicon or chlorine .....	2.00

## Combinations:

Gold and Silver .....	1.00
Copper and iron, or lead and iron .....	1.50
Insoluble, copper and lead .....	2.00
Insoluble, copper and iron .....	2.00
Insoluble, lead and iron .....	2.00
Insoluble, zinc and iron .....	2.50
Insoluble, lead, copper and iron .....	2.50
Gold, silver, copper and lead .....	2.50
Gold, silver, copper, iron and insoluble .....	2.50

## SPECIAL CHEMICAL DETERMINATIONS

## One element only:

Aluminum, or tungsten, or barium, or chromium .....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorus....	4.00
Nickel, or cobalt, or molybdenum, or vanadium .....	5.00

## CHEMICAL ANALYSIS

Coal and coke analysis, giving moisture, volatile combustible matter, fixed carbon and ash .....	5.00
The same, including determination of sulphur and phosphorus .....	7.50
Silicate analysis .....	15.00
Cement analysis (chemical) .....	15.00
Cement analysis (mechanical) .....	2.50
Cement tests for strength and soundness by the Department of Civil Engineering .....	5.00
Boiler water analysis .....	10.00

## CONSIGNMENTS AND REMITTANCES

Samples, ores, and other consignments should be shipped to the University of Arizona, Tucson, Arizona. Small quantities may best be sent by parcel post; larger quantities by express or freight.

All assays, chemical determinations and chemical analyses, except gratuitous qualitative tests mentioned elsewhere, must be paid for in advance. Remittances should be made by postoffice money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to University of Arizona.

## AGRICULTURAL EXPERIMENT STATION

Arthur H. Wilde, Ph. D., President of the University.

Robert H. Forbes, M. S., Director.

John James Thornber, A. M., Botanist.

Albert E. Vinson, Ph. D., Biochemist.

Clifford N. Catlin, A. M., Assistant Chemist.

Frederick W. Wilson, M. S., Animal Husbandman.

G. E. P. Smith, C. E., Irrigation Engineer.

Arthur L. Enger, B. S., Assistant Engineer.

Robert W. Clothier, M. S., Agriculturist.

Alexander M. McOmie, B. S., Assistant Agriculturist.

Stanley F. Morse, B. A. S., Acting Agriculturist.

George F. Freeman, B. S., Plant Breeder.

Johannes C. Th. Uphof, Assistant Plant Breeder.

William H. Lawrence, M. S., Horticulturist.

Austin W. Morrill, Ph. D., Entomologist.

Charles E. Grassick, Secretary.

Ruth E. Heagy, Librarian.

Eunice Waller, Stenographer.

## ORGANIZATION AND WORK

The Agricultural Experiment Station is a legally constituted department of the University organization, whose purpose is to aid "In acquiring and diffusing useful and practical information on subjects connected with agriculture and to promote scientific investigation and experiments respecting the principles and applications of agricultural science."

The activities of the Experiment Station include research and experimentation in Agriculture, Horticulture, Animal Husbandry, Botany, Entomology, Plant Breeding, Chemistry and Irrigation investigations, the whole or a major portion of the time of one or more members of the Station Staff being devoted to each of these lines of Station work. Provision is also made for Farmers' Institutes, for a Farmers' Demonstration Train, and for advisory work in Farm Management, by means of which the results of experiments and investigations in agriculture are carried to farms throughout the State.

Owing to wide variations in agricultural conditions in Arizona it has been found of advantage to distribute the various branches of Station work with reference to conditions required for its satisfactory accomplishment as follows:

The administrative offices, and the botanical, plant breeding, chemistry and irrigation laboratories are maintained at Tucson in the

University buildings. From this base of operations the three great agricultural districts of the State—Salt River Valley, the lower Colorado Valley, and the upper Gila district are accessible with equal convenience for field work and observations.

The main Experiment Station farm has been maintained near Phoenix in Salt River Valley, which is intermediate in elevation and in mean yearly temperature with respect to the irrigated valleys of Southern Arizona. Results obtained at this point are therefore capable of general application in the southern part of the State.

The date palm orchard, conducted in cooperation with the U. S. Department of Agriculture, is situated in the alkaline district at Tempe where successful experimentation with this palm will be of great value in demonstrating a use for extensive areas of alkaline land in the Southwest.

The demonstration farm, near Yuma, in the fertile valley of the Colorado River, has also afforded a succession of object lessons to the local public, and has contributed information concerning crops, agricultural methods and markets for this rich region.

Experiments in dry-farming have been initiated on a new tract secured for the purpose near Cochise, in Sulphur Spring Valley, in the neighborhood of Snowflake in Navajo County, and near Prescott, Arizona, in localities typical of large areas. The grazing range reserve, also, for the study of worn out range country, with a view to its reclamation, is conducted in a typical district of intermediate elevation near Tucson, cooperating with the U. S. Department of Agriculture.

The University farm and a plant breeding garden rented of the Evergreen Nursery afford facilities for botanical and plant breeding studies. Laboratories, green houses and small gardens on the University grounds serve a similar purpose. The results of Experiment Station work are published at intervals in the bulletins and reports of the Station. The longer and more technical reports and annual bulletins state in considerable detail the results of investigations as they mature. Timely Hints for Farmers, which are brief readable writings, are issued at the time when they will be most useful and are written in plain language and presented in popular form. By means of a publicity service organized during the past year still further circulation is given to matters of agricultural interest through the newspapers of the State.

Inasmuch as for years past the mailing list has enabled the Station to reach 40 to 50 per cent. of the farming population of Arizona, it is



not surprising that the effects of Station work are now generally in evidence throughout the State, more particularly in our irrigated southern valleys.

Supplementing the Federal appropriations and for the purpose of a more liberal endowment of agricultural investigations within Arizona, the First State Legislature appropriated \$252,800.00 for the two years beginning July 1, 1913, for agricultural uses, as follows:

A new agricultural building at the University .....	\$165,000.00
Dry-farming experiments near Prescott, Snowflake and in Sulphur Spring Valley .....	18,000.00
Intensive farming and date palm studies near Yuma .....	10,000.00
Horticultural investigations .....	5,000.00
Underflow water investigations .....	2,500.00
Plant introduction and breeding .....	4,000.00
Printing and binding .....	4,500.00
Farmers' Institutes .....	8,800.00
Office and Library service .....	5,000.00
160 acres of additional land in Salt River Valley .....	30,000.00
	<hr/>
	\$252,800.00

In addition to these items the sum of \$23,500 was appropriated for agricultural instruction at the University for the biennium beginning July 1, 1913.

With this endowment and with an organization which brings the agricultural work of the University in wide contact with the farming interests of the State, "The farmers' college" has entered upon an epoch of increasing usefulness to the growing agricultural interests of Arizona.

## THE SUB-COLLEGIATE DEPARTMENT

Faculty 1913-1914

Arthur Herbert Wilde, Ph. D., President.

Ida Christian Reid, Ph. M., Principal. History and Mathematics.

William Sleeper Aldrich, M. E., Shop Work and Drawing.

Andrew Ellicott Douglass, Sc. D., Physics.

Stanley Fletcher Morse, B. A. S., Agriculture.

George Le Roy Brown, U. S. A., Military Science.

Charles Alfred Turrell, A. M., Spanish and French.

William George Medcraft, A. M., Mathematics.

Paul H. M. P. Brinton, M. S., Chemistry.

Levona Payne Newsom, Ph. D., Latin and Greek.

Frederick W. Wilson, M. S., Animal Husbandry.

Arthur Hamilton Otis, A. B., German.

Elsa Chapin, A. B., English and Physical Training.

Raymond S. Quigley, B. S., Athletics and Physical Training.

## GENERAL INFORMATION

*By vote of the Regents of the University the first year of the Sub-Collegiate Department was discontinued after June, 1912, and the second year after June, 1913; much of the work of the third year will be discontinued after June, 1914.*

This department gives only such subjects as supplement defective training for college entrance requirements; yet it offers an opportunity to the students from the small high schools, having only two or three years of work, to complete their academic training.

Admission to the sub-collegiate courses presupposes the completion of two years of high school work. Students who do not bring certificates showing the completion of this work must take examinations to test their ability to pursue profitably the work desired and any deficiency must be made up in a manner approved by the University. A certificate is granted to all students who have completed satisfactorily the work required for entrance to the Liberal Arts courses of the University. Students who have completed the entrance requirements of a university course are admitted to that course without examination.

## LIVING ACCOMMODATIONS AND EXPENSES

A portion of the South Hall is set apart for the use of male sub-collegiate students; young women are accommodated in West Cottage. A health certificate is required of all students registering in the University. Details of furnishings and living expenses are set forth in a paragraph earlier in this catalog. These expenses are substantially the same for both college and sub-collegiate students, save that laboratory fees and book bills are higher for the former. The expenses necessarily incurred during the academic year are about \$300 but of this amount nearly one-third falls due in the first month, or in the six weeks before November 1st, in the form of charges which are made but once during the year.

The entrance requirements to the various University courses are repeated below for the convenience of the sub-collegiate student.

Admission requirements for the four-year course in Agriculture are Science course:

English .....	3 units*	American History ½ and	
Language other than English .....		Civics ½ .....	1 unit
Mathematics (1 ½ algebra, 1 plane geometry ..	2 units	Physics, Chemistry or	
		Biology .....	1 unit
	2 ½ units	Electives .....	5 ½ units
		Total, 15 units	

Admission requirements for the four-year course in Agriculture are the same as those for the general B. S. degree, excepting that language, other than English is elective. Admission to the short course in Agriculture does not require previous high school work.

Admission requirements for the engineering courses are as follows:

English .....	3 units	Mathematics .....	3 units
Language other than English .....		Physics or Chemistry .....	1 unit
	2 units	Electives .....	6 units
		Total, 15 units	

For Civil, Electrical, and Mechanical Engineering, Physics is required.

For Mining Engineering both Physics and Chemistry are required, leaving only five electives.

## OUTLINE OF STUDIES

## ENGLISH

The course in English presents the fundamental requirements of grammar and rhetoric, to acquaint the student with good literature,

\*A unit represents a subject pursued for one year with five recitation periods a week.

and to establish good habits in written and oral expression and in reading. The time is therefore divided between the study of composition and literature.

COMPOSITION AND RHETORIC. Principles of rhetoric applied to structure of expository themes and informal argument; topical outlines; analysis of essays studied in class.

LITERATURE. Dickens *David Copperfield*, Macaulay, *Essays on Addison and Johnson*, Wordsworth *Short Poems*, Burke *On Conciliation*, Lincoln *Selected Speeches*, Milton *Short Poems*, Shakespeare *Twelfth Night*, *Macbeth*, Spenser one book of *Faerie Queene*, Chaucer *Prologue*.

#### MATHEMATICS

ALGEBRA. Second year, one semester; involution, evolution, theory of exponents, radicals, quadratic equations and proportion. This course is required for entrance to the engineering courses in college.

SOLID GEOMETRY. Second semester, with original exercises.

#### MECHANIC ARTS

This work consists of both drawing and shop work, between which subjects the student's time is equally divided. The course covers one year and furnishes a thorough elementary knowledge of manual training as taught in the secondary schools of the country.

DRAWING. Freehand sketching in perspective and orthographic projection. Reinhart's lettering, freehand working drawings. Mechanical drawing and geometrical problems.

SHOP WORK. "Sloyd," care and use of woodworking tools. Forging, joining, wood turning.

#### SCIENCE

The courses in science initiate the student into the processes and methods used in laboratory work; teach close observation, careful manipulation and logical deduction, together with the fundamental facts of the various branches of science.

#### AGRICULTURE

The following courses in Agriculture may be elected by preparatory students: Agr. 1 (Plant Culture), Agr. 2 (Farm Crops), Agr. 3 (Live Stock Judging), Agr. 4 (Elements of Dairying), Agr. 11 (History of Breeds), Agr. 12 (Poultry), Agr. 26 (Horticultural Crops).

Any two of the above half-year courses will count one credit in the preparatory course. For description of the courses, see index under Agriculture.

## BIOLOGY

The course extends through the year, botany being offered the first semester, zoology the second. The plant is studied as a living individual in all its relations; plant societies and plant groups. Text, Coulter, *Plant Studies*. Types of invertebrates and vertebrates are studied in regard to anatomy, physiology, habits, etc. Text, Kellogg, *The Animals and Man*.

## CHEMISTRY

A year's work with the text and in the laboratory, in such proportions as the instructor decides upon. Each student must keep a notebook in which he describes the process and results of his laboratory work.

## PHYSICS

The course shows that physics is not something abstract or mysterious, but is the simple explanation of everyday occurrences not usually understood and often unnoticed. It consists of three recitation periods and four laboratory periods per week, pursued along the lines laid down for the senior year in secondary schools. Each student keeps a notebook in which a minimum number of experiments are written up.

## HISTORY

The work in history leads the pupil to see the development of the American people along political, social, and economic lines, and to arouse in him a love for the subject and a habit of broad and discriminating reading.

The text in history will be James and Sanford, *American History*, or Channing, *Students' History of the United States*. In civics the historical development of the subject is made prominent, while practical problems, such as taxation and municipal government, are made the subjects of special investigation and study. Hart, *Actual Government*, or Foreman's *Advanced Civics*, is the textbook.

## LATIN, GREEK, FRENCH, SPANISH, AND GERMAN

One of these languages must be pursued for at least two years.

For an outline of the courses in Latin, Greek, French, Spanish and German, see under requirements for admission.

## MILITARY SCIENCE AND PHYSICAL TRAINING

Military Science and Tactics are required of all male students and physical training for female students.



## HONORS, PRIZES AND SCHOLARSHIPS, 1912-13, 1913-14

## GRADUATES OF THE UNIVERSITY, JUNE 1913

Marguerite Bernice Brown, Bachelor of Arts

Helena May Kelly, Bachelor of Arts

Arthur Luccock Lovejoy, Bachelor of Arts

Hazel Ida Schoonmaker, Bachelor of Arts

Laura May Swan, Bachelor of Arts

Horace Merle Cochran, Bachelor of Science

Loyd Creighton Elliott, Bachelor of Science

Howard Wilmot Estill, Bachelor of Science

Henry Alden Foster, Bachelor of Science

Ralph Crawford Young, Bachelor of Science in Civil Engineering

William Francis Brewer, Bachelor of Science in Mining Engineering

Henry Oliver Coles, Bachelor of Science in Mining Engineering

Guy Leslie Wilky, Bachelor of Science in Mining Engineering

James Gary Lindley, Bachelor of Science in Metallurgy

William Harold Munds, Bachelor of Science in Metallurgy

Lyman Dalton LaTourrette, Bachelor of Science in Agriculture

Ernest Lee Barnes, Bachelor of Science in Economics

## GRADUATES OF THE SUB-COLLEGIATE DEPARTMENT, JUNE, 1913

Calvert Adams

Hugh Campbell

Keith Davey

Arthur L. Davidson

John Brooks Glenn

Walter Grimes

Turbese D. Lummis

Helen Powers

Andrew Rebel

Ernest J. Renaud

Buckley A. Wheeler

Arthur L. White

The University gives formal recognition to the highest attainment in scholarship. Those students who meet the requirements of the faculty are entitled to Senior, Junior, and Sophomore Scholarships in those respective years, and to Honorable Mention in the Freshman year and in the Senior year of the Preparatory Department. University Honors are awarded to those who receive class honors in both junior and senior years. These Scholarships carry no financial remuneration, but are recognized as the highest undergraduate distinction attainable.

In the year 1912-13 Honors were awarded as follows:

University Honors, Loyd C. Elliott, Howard W. Estill

Senior Honors, Horace Merle Cochran, Henry A. Foster, Laura M. Swan

Junior Honors, Maud MacPherson

Honorable Mention in the Preparatory Graduating Class, John Brooks Glenn

## PRIZES

### THE MILITARY PRIZES

For their interest in the military department of the University Captain Hiram M. Powell, late Commandant of Cadets, and Mr. Merrill P. Freeman of Tucson, sometime regent of the University, have annually presented prizes to the best drilled students,—a saber, the gift of Captain Powell, to the most efficient commissioned officer, and a medal, the gift of Mr. Freeman. Since the death of Captain Powell the gift of the saber is continued by Mrs. Powell. In the year 1912-13 these prizes were awarded as follows:

The Powell Saber, Walter M. Brewer.

The Freeman Medal, J. Preston Jones.

For the year 1913-1914 the requirements for the Freeman medal will be increased, the recipient being proficient not only in the military department but also in other work in the University and also of high standing in character and conduct.

Colonel George LeRoy Brown, head of the military department, offers a medal to the most efficient non-commissioned officer, and another for the best drilled private.

### THE DRACHMAN PRIZES

Mr. Harry A. Drachman, of Tucson, offers to the students of the University two annual cash prizes of \$25 and \$15 respectively, the contest open to all college students of the University. During the academic year 1913-1914, the prizes are offered for the two best debates.

### THE TROUTMAN MEDALS

Dr. George D. Troutman, of Tucson, to stimulate interest among the students in the chemistry of pure foods, offers two medals, of gold and silver, as prizes for superior work in chemistry. In the year 1912-13 these medals were awarded as follows:

Gold Medal, Howard W. Estill

Silver Medal, Marcus T. Kendall

The Bennett Scholarship has been held during the year 1913-14 by Alice Patton Lawson.

The County Scholarships for the year 1913-14 are held by

James C. Cook, Cochise County

Hans Harders, Gila County

Leland Heywood, Graham County

Virgil E. Weiss, Greenlee County

Lynn L. Dunklin, Navajo County

Gladys Gibbs, Pima County

Harry T. Hobson, Santa Cruz County

Mary Jolly, Yavapai County

Orville S. McPherson, Yuma County

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## THE STATE SCHOOL FOR THE DEAF

Pursuant to an act of the legislature of the State in 1912, a School for the Deaf and Dumb was established in September, 1912, in affiliation with and under the direction of the University. The school has its own buildings adjacent to the University campus.

During the current year eighteen students have been in attendance. The work of the school is as carefully graded as possible, considering the widely different preparation of the various pupils. Instructors and equipment are provided as needed for most efficient work.

Application for admission to the School for the Deaf is made to the Superintendent of Public Instruction at the Capitol in Phoenix, and on approval will be referred to the President of the University and to the Principal of the School, who will notify the applicant of the acceptance of the application. The requirements set by the State for admission to the School may be learned on inquiry of the Principal, who will forward the blank to be filled and returned to the Superintendent of Public Instruction. All communications should be addressed, The School for the Deaf, Tucson, Arizona.

## REGISTER OF STUDENTS

## GRADUATE STUDENTS

Cochran, H. Merle  
Lewis, Virginia Elnora

Mack, Josephine E  
Waterbury, Leslie A.

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## SENIORS

Backstein, Rytha F  
Bradstreet, Herbert N.  
McPherson, Maud  
Merritt, Richard

Micotti, Alfred D.  
Rogers, Frederick W.  
Wetencamp, Paul F.  
Wooddell, Grace H.

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## JUNIORS

Abbott, Frank R.  
Aylworth, Herbert R.  
Barkley, Bessie J.  
Benedict, Arthur A.  
Brewer, Walter M.  
Culin, Frank L., Jr.  
Curry, Esther M.  
Duffy, Catherine G.  
Gameros, Luis G.  
Goyette, C. Edgar  
Guild, Marilla M.  
Hawley, Alsea

Hayhurst, Normal C.  
Jackson, Lawrence R.  
Lawson, Alice  
La Tourrette, Verne G.  
Lepper, Lewis E. W.  
Luis, Franklin A.  
Lynch, Eugene R.  
Minister, Percy F.  
Moody, Marguerite  
Oxley, Edward B.  
Rockfellow, Julia  
Rodee, Nona C.  
Thornber, Harriet B.

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## SOPHOMORES

Arozena, Joe de  
Balderas, Charles B.  
Bates, Rosalind  
Beach, Charles P.  
Beaton, Robert S.  
Bell, Ralph L.  
Benzie, Inez M.  
Brinton, Mary P.  
Bristow, William P.  
Carter, Mabel R.  
Clancy, Katherine  
Clark, Carl W.  
Cloud, Leo F.  
Cole, David  
Condron, Albert H.  
Dill, Prentice W.  
Fickett, Webster L.  
Gammage, Grady  
Getsinger, Joseph W.  
Gibbs, Gladys V.  
Hedgepeth, John A.  
Hobson, Frank J.  
Hobson, Harry T.  
Hoy, Catherine S.  
Jones, Allen C.  
Jones, Collins R.  
Jones, J. Preston

Kendall, Marcus T.  
Kriegbaum, Lawrence L.  
Lindsley, Richard G.  
McIntosh, J. Angus  
Miner, Bert  
Murfhey, Charles E.  
Palmer, Elizabeth  
Parry, Katherine  
Pickrell, W. W.  
Piper, Marvin M.  
Pistor, Anna F.  
Pistor, Carl W.  
Randall, Wainwright  
Reynolds, Ralph L.  
Rigg, Ralph Lee  
Rogers, Edgar A.  
Rolph, Inez K.  
Scheerer, George W.  
Sessions, Alma P.  
Shattuck, Henry  
Smith, J. Fish  
Smith, Turner C.  
Steinegger, William  
Vaughan, William Wallace  
Voller, John W.  
Whisler, Lois H.

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## FRESHMAN

Brown, Dudley  
 Brown, Ruth O.  
 Campbell, Helen E.  
 Campbell, Hugh D.  
 Clawson, George A.  
 Caruthers, Sam R.  
 Cavanaugh, James A.  
 Chapman, John O.  
 Cook, James C.  
 Crawford, Albert Jr.  
 Dunklin, Lewis L.  
 Everest, Raymond B.  
 Fickett, Fred W. Jr.  
 Ford, Phyllis M.  
 Galloway, James R.  
 Gardiner, John H.  
 Gibson, Carlos  
 Glennon, Joseph H.  
 Grabe, William F.  
 Grimshaw, Henry H.  
 Hannah, Bruce  
 Harders, Hans H.  
 Heywood, Leland  
 Hield, H. H.  
 Hofmeister, Carl  
 Isaac, Stover  
 Jackson, William A.  
 John, Donald J.  
 Jolly, Mary Lewis  
 Jones, Arthur B.  
 Klein, Leonard  
 La Tourrette, Rena C.  
 Lawton, Charles B.

Leavitt, Frank M.  
 Lescher, Charles L.  
 MacDonald, Howard J.  
 McClure, Frank G.  
 McNulty, Peter  
 McPherson, Orville S.  
 Mack, Francis C.  
 Maffeo, James S.  
 Martin, Jack B.  
 Merritt, George M.  
 Miller, George W.  
 Miller, Wallace  
 Mills, James S.  
 Nelson, Ruth  
 Odell, Mabel S.  
 Parmley, Myrtle V.  
 Payne, Stanley T.  
 Pitrat, Julius E.  
 Renaud, Ernest J.  
 Roberts, Bertha M.  
 Schon, August L.  
 Schwalen, Harold C.  
 Sheppard, Alice L.  
 Shoemaker, Earl W.  
 Spires, Ethel N.  
 Stewart, Robert I.  
 Warner, Albert  
 Waters, Josephine H.  
 Weiss, Virgil E.  
 Whipp, Homer  
 White, Arthur S.  
 Wilky, Clara  
 Wright, Esther A.

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## SPECIAL COLLEGE STUDENTS

Ball, Louise  
 Bass, H. L.  
 Brady, Anita  
 Brown, Beryl  
 Buehman, Albert H.  
 Carlson, John I.  
 Carr, Clara  
 Cavanaugh, Helen C.  
 Clark, Gladys M.  
 Cornelius, Jane  
 Eldred, Mary  
 Ginn, Edna  
 Goudie, Mary G.  
 Graham, Mrs. W. F.  
 Gwyn, Guy  
 Haley, Helen  
 Harrison, Maude  
 Hatch, William H.

Heckman, Alice M.  
 Hoffman, C. R.  
 Hofmeister, Irene L.  
 Horstman, Edna  
 Hurst, Karl T.  
 Johnson, Eleanor  
 Kelly, Mrs. A. M.  
 Kenny, T. P.  
 Langworthy, Dell R.  
 Loewenthal, Luis H.  
 MacKay, Kathryn  
 Maggenheimer, Floriene R.  
 Marshall, Thomas K.  
 Mashbir, Mrs. Sidney F.  
 Metzger, Mrs. Jeremiah  
 Moore, Mrs. Kirke T.  
 Nixon, Mrs. H. C.  
 Otis, Mrs. A. H.  
 Parmley, Abigail E.



Rosemond, Alice	Townsend, Salome
Rowley, Iva S.	Upham, Ethel
Rowley, W. S.	Watson, Mrs. Samuel
Samuels, Agnes	Willis, Helen H.
Steele, Lucile J.	Wolfe, D. J.

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## SUBCOLLEGIATE STUDENTS

Acker, Nydia M.	Kizer, Ruth A.
Ashby, Rollo W.	Keegan, James
Bayze, Thomas S.	Keys, Clara C.
Becker, Henry	Lynch, George B.
Bostrum, Enoch	Martin, Ina C.
Clemons, Paquita	Mayhew, Henry H.
Clemons, Philip de R.	Park, Lorna J.
Crowley, Thomas N.	Parker, Malvene
Davison, Rowland A.	Rae, Jessie Esther
Duffy, Francis R.	Randall, Sydney S.
Estill, Edward H.	Renaud, Charles L.
Finch, Hunter J.	Robbins, Faye E.
Forbes, Helen C.	Roberts, Helen H.
Gough, William G.	Roche, Harley E.
Griffith, Helen B.	Rohrer, John P.
Griggs, Cecil W.	Rosenstern, Blanche A.
Hoge, Fulton W.	Rowell, Robert S.
Holladay, Lawrence E.	Smith, Margaret
Hosmer, Mercedes	Truman, Irving F.
Hubbell, Thomas S.	Whiteside, Thomas S.
Jenney, William L. B.	Wilson, Letha Belle
Johnson, Maude V.	Wood, Herbert R.
Jordan, Chester A.	Woods, Gladys

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VOLUME VII, NUMBER 1  
JUNE, 1914.



# University of Arizona Record

Annual Catalogue  
1914-1915







UNIVERSITY OF ARIZONA  
TUCSON, ARIZONA

SUBJECTS	No. of Credits	No. of Weeks	Times a Week	Length of Recitation Period	Grade
English, 1st yr.....					
English, 2nd yr. ....					
English, 3rd yr. ....					
English, 4th yr. ....					
Algebra .....					
Plane Geometry....					
Solid Geometry . ...					
Trigonometry .....					
Latin .....					
German .....					
French .....					
Spanish.....					
Greek.....					
History.. ..					
Civics .....					
Physics .....					
Chemistry .....					
Botany .....					
Zoology .....					
Geology .....					
Physical Geography .....					
Physiology .....					
Agriculture.....					
Industrial Training .....					
Commercial Subjects ..					
Domestic Science. ....					
Music.....					
Drawing.....					
Other Subjects.....					

# University of Arizona Record

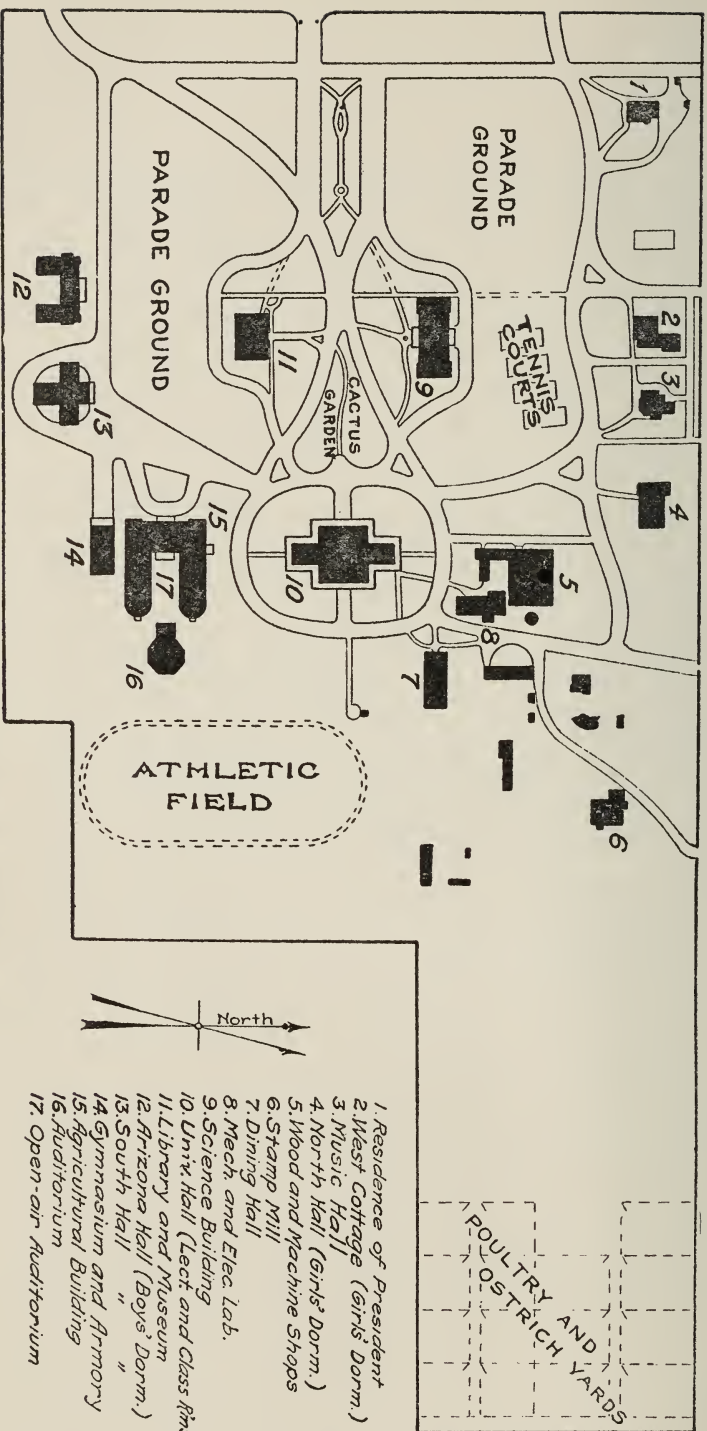
The Annual Catalogue  
1914-1915

With Announcements for  
1915-1916

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Volume VIII, Number 1, June, 1915

RAW



1. Residence of President
2. West Cottage (Girls' Dorm.)
3. Music Hall
4. North Hall (Girls' Dorm.)
5. Wood and Machine Shops
6. Stamp Mill
7. Dining Hall
8. Mech. and Elec. Lab.
9. Science Building
10. Univ. Hall (Lect. and Class Rms)
11. Library and Museum
12. Arizona Hall (Boys' Dorm.)
13. South Hall
14. Gymnasium and Armory
15. Agricultural Building
16. Auditorium
17. Open-air Auditorium

# UNIVERSITY of ARIZONA



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# 1915

## JANUARY

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
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## FEBRUARY

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## MARCH

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## JUNE

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## JULY

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## AUGUST

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## SEPTEMBER

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## OCTOBER

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## DECEMBER

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# 1916

## JANUARY

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## FEBRUARY

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## MARCH

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## APRIL

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## JUNE

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## JULY

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## AUGUST

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## SEPTEMBER

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## OCTOBER

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## NOVEMBER

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## DECEMBER

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24	25	26	27	28	29	30
31	..	..	..	..	..	..

# UNIVERSITY CALENDAR

1915-16

## FIRST SEMESTER

September 17, 18, Friday and Saturday	Matriculation and registration of new students
September 20, Monday	Entrance examinations
September 21, Tuesday	Registration of old students
October 2, Saturday	Class work begins
November 25, Thursday	Condition examinations
December 22, Wednesday evening to January 2, Sunday evening	Holiday
January 8, Saturday	Christmas recess
January 24, Monday to January 28, Friday inclusive	Condition examinations
	Semester examinations

## SECOND SEMESTER

January 29, Saturday	Last day for registration
January 31, Monday	Class work begins
February 22, Tuesday	Holiday
April 8, Saturday to April 12, Wednesday, p. m.	Annual encampment of battalion
April 10, Monday to April 15, Saturday inclusive	University Week
May 13, Saturday	Condition examinations
May 28, Sunday	Baccalaureate Sunday
May 29, Monday	Senior Day
	Examinations begin
May 30, Tuesday	Holiday
	Commencement
June 3, Saturday	Examinations end



# ORGANIZATION OF THE UNIVERSITY

---

The University comprises the following colleges and departments:

College of Letters, Arts, and Sciences, including among others—

Departments of Law, Education, and Music

College of Agriculture

Agricultural Experiment Station, including—

Range Study Tracts, Tucson

Experiment Station Farm, Phoenix

Date-Palm Orchard, Tempe

Demonstration Farm and Date-Palm Orchard, Yuma

Northeastern Dry-Farm, Snowflake

Prescott Dry-Farm, Prescott

Sulphur Spring Valley Dry-Farm, Cochise

University Farm, Tucson

Experimental and Demonstration Farm, Mesa

College of Mines and Engineering

State Bureau of Mines

University Extension Service, including—

General Extension Department

Agricultural Extension Department

# OFFICERS OF THE UNIVERSITY

---

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### EX-OFFICIO

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Governor of Arizona	
THE HONORABLE CHARLES O. CASE.....	Phoenix
Superintendent of Public Instruction	

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*Superintendent, Agricultural Extension Department*
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*Assistant Agriculturist, Agricultural Experiment Station*
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*Assistant Professor of History; Dean of Women*
- HOWARD ARCHIBALD HUBBARD, A. M. 109 Olive Road  
*Assistant Professor of History and Social Science*

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\*Absent on leave 1915-1916

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*Instructor in Chemistry; Assistant Chemist, Agricultural Experiment Station*
- ANITA CALNEH POST, Ph. B. 832 E. Fifth St.  
*Instructor in Romance Languages*
- JOHANNES CORNELIUS THEODORUS UPHOF 207 E. Third St.  
*Instructor in Plant Breeding; Assistant Plant Breeder, Agricultural Experiment Station*
- WILLIAM SEATON HENDRY 903 E. Seventh St.  
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*Farm Advisor, Agricultural Experiment Station*
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*Instructor in Electrical Engineering*
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- JAMES FRED MCKALE, A. B.  
*Director of Athletics*
- JESSAMINE CHAPMAN WILLIAMS, B. S. 721 E. Fourth St.  
*Instructor in Home Economics*



ARTHUR LEE PASCHALL, B. A. S.

*County Farm Demonstrator, Agricultural Experiment Station*

JAMES ALEXANDER ARMSTRONG, B. S.

*County Farm Demonstrator, Agricultural Experiment Station*

LELAND F. PARKE

*State Club Agent, Agricultural Extension Department*

HAROLD ROTHWELL SPAULDING, B. A. S.

*Agronomy Specialist, Agricultural Experiment Station*

FELLOW ASSISTANTS

ALFRED D. MICOTTI, B. S. in C. E. *Assistant in Civil Engineering*

LEON HENRI STRONG, A. B. *Assistant in Biology*

STUDENT ASSISTANTS

PAUL H. GIBBS *Assistant in Biology*

PERCY F. MINISTER *Assistant in Mineralogy and Chemistry*

ALBERT CRAWFORD, JR. *Assistant in Chemistry*

CARL PISTOR *Assistant in Mechanic Arts*

JOSEPH W. GETSINGER *Assistant in Physics*

HORACE HIELD *Assistant in Physics*

HENRY H. GRIMSHAW *Assistant in the Museum*

ASSISTANTS IN MILITARY SCIENCE AND TACTICS

CHARLES A. MESERVE, Ph. D. *Commandant of Cadets*

IRA ERVEN HUFFMAN, M. D. *Lecturer in Military Hygiene*

FREDERICK DICKLEY, U. S. A. *Ordnance Officer*

WILLIAM H. THOMPSON *Director of Rifle Practice*

VERNE G. LATOURRETTE *Assistant in Rifle Practice*

WALTER M. BREWER *Assistant in Tactics*

J. PRESTON JONES *Assistant in Tactics*

GEORGE W. SCHEERER *Assistant in Tactics*

## EXECUTIVE OFFICERS

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ANDREW ELLICOTT DOUGLASS, A. B., Sc. D.	<i>Secretary Academic Senate</i>
FRANK CALEB KELTON, B. S.	<i>Registrar</i>
IDA CHRISTINA REID, Ph. M.	<i>Dean of Women</i>
CASSELL WESLEY ADKINSON	<i>Acting Financial Secretary</i>
ESTELLE LUTRELL, A. B.	<i>Librarian</i>
ALVA OTIS NEAL, M. S.	<i>High School Visitor</i>
CHARLES FRANCIS WILLIS, B. S.,	<i>Director, Bureau of Mines</i>
JOHN JAMES THORNBER, B. S., A. M.	<i>Acting Director of the Museum</i>
STANLEY FLETCHER MORSE, B. A. S.	<i>Superintendent, Agricultural Extension Department</i>
ADA ENGLISH	<i>Secretary to the President</i>
CORNELIA RICHERT POINDEXTER	<i>Matron</i>
THOMAS R. BLAIR	<i>Assistant Bookkeeper</i>
WILLIAM J. BRAY	<i>Acting Superintendent of Buildings</i>
CHARLES EDWARD GRASSICK	<i>Secretary, Agricultural Experiment Station</i>
JOSE HIGUERA	<i>Head Gardener</i>
EUNICE WALLER	<i>Secretary, Agricultural Extension Department</i>
RUTH MURPHY	<i>Stenographer, Agricultural Experiment Station</i>
ALICE M. HECKMAN	<i>Secretary, Bureau of Mines</i>
ALICE P. LAWSON	<i>Clerk, Registrar's Office</i>

## LIBRARY OFFICERS

ESTELLE LUTRELL, A. B.	<i>Librarian</i>
MABEL AENELLA GUILD	<i>General Assistant Librarian</i>
HELEN M. A. MILLER	<i>Assistant in Agriculture</i>
ELSIE WINDSOR	<i>Catalogue Assistant</i>
MARY L. JOLLY	<i>Accession Assistant</i>
CARL RUPPERT	<i>Shelf Assistant</i>

COMMITTEES OF THE FACULTY

1914-1915

ADMINISTRATION :

Professor Guild, Colonel Brown, Professors Douglass, Forbes, Turrell, Reid.

ALUMNI RELATIONSHIPS :

Professors Kelton, Thornber, Reid, Miss Post.

ASSEMBLY :

Professors Douglass, Perry, Newsom, Mr. Hendry.

ATHLETICS :

Colonel Brown, Professors Meserve, Kelton, Medcraft, Mr. McKale

BUREAU OF RECOMMENDATION :

Professors Neal, Hubbard, Newsom

CURRICULUM :

Professors Clapp, Brinton, Turrell, Thornber, Newsom

DELINQUENT STUDENTS :

Professors Hubbard, Brinton, Clapp, Freeman, Marshall

DOUGLAS FUND :

Professors Douglass, Clapp, Guild, Henley, Willis

EXTENSION WORK :

Professors Turrell, Forbes, Meserve, Morse, Newsom, Willis

LIBRARY :

Professors Lutrell, Guild, Perry, Vinson, Hubbard, Newsom, Mr. Brown

PROGRAM :

Professors Henley, Lawrence, Turrell, Mr. Brown

PUBLICATIONS :

Professors Forbes, Clapp, Morse, Perry, Otis

REGISTRATION :

Professors Kelton, Henley, Vinson, Medcraft, Otis, Reid

RHODES SCHOLARSHIP : -

President von KleinSmid, Professors Guild, Bates

## SOCIAL LIFE AND STUDENT ENTERPRISES:

Professors Reid, Douglass, Henley, Perry, Willis, Miss Chapin,  
Mr. McKale

## SPECIAL UNIVERSITY OCCASIONS:

Professors Otis, Medcraft, Thomas, Miss Post.

## STUDENT LOAN FUND:

Professors Brinton, Meserve, Kelton

## STUDENT RESIDENCES:

Colonel Brown, Dean Reid

# GENERAL INFORMATION

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## PURPOSE AND GOVERNMENT

### GENERAL STATEMENT

The University of Arizona is an integral part of the system of public education established by and for the State. Its purpose, in the language of the organic law, is "to provide the inhabitants of this State with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and, in so far as possible, a technical education adapted to the development of the peculiar resources of Arizona. In furtherance of this purpose the College of Letters, Arts, and Sciences, the College of Mines and Engineering, the State Bureau of Mines, the College of Agriculture, and the Agricultural Experiment Station, have been organized. In creating the University, the Legislative Assembly wisely unified under one management these various schools and institutions of higher learning and investigation.

The general organization of the University is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of 1901.

### THE BOARD OF REGENTS

The government of the institution is vested in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and the Superintendent of Public Instruction of the State, ex-officio, and eight members appointed by the Governor, not more than four of whom shall belong to the same political party. The appointment is made subject to the advice and consent of the Senate. The term of office is four years, beginning on the first Monday in August succeeding the appointment, and continuing until the appointment of a successor. In case of vacancy the Governor fills the office by appointment and the person so selected remains in office till the close of the next legislature and until another selection is made. The Board elects a presiding officer who is Chancellor of the University and, ex-officio, President of the Board. It also selects its own Secretary, Treasurer, and Librarian.



The Board of Regents has power to control and manage the University and its properties, to enact laws governing the University, to appoint and employ a President of the University and the requisite number of professors and tutors, and to determine salaries. While the immediate government of the various departments is placed in the faculties, the Board of Regents has power to regulate instruction and under advice of the faculty to prescribe books and authorities used therein. It has the power to confer degrees and grant diplomas as is usual in such institutions. The regular meetings of the Board are held on or near the tenth of each month.

## **FACULTIES**

**The University Council**—The University Council of Administration is composed of the President and Deans of the several colleges of which the University is composed, and is to exercise such powers as the Board of Regents may confer upon it.

**The Academic Senate**—The Academic Senate is composed of the Faculties of the University, and must conduct the general administration of the University, regulate the general and special courses of instruction, receive and determine all appeals from acts by the Faculty of any college, and exercise such other powers as the Board of Regents shall confer upon it. The proceedings of the Senate must be conducted according to the rules of order adopted by it, and every person engaged in instruction in the University may participate in its discussion. The right of voting, however, is confined to the President, Professors, Associate Professors, and Assistant Professors.

**The Faculties of the Several Colleges**—The immediate government of the several colleges is entrusted to their respective Faculties, each of which must have its own organization, regulate its own immediate affairs, subject to the approval of the academic senate, and may recommend courses of study and text-books to be used.

## **MAINTENANCE AND ENDOWMENT**

The University is maintained by funds appropriated by the United States and by the State of Arizona.

**Federal Support**—By the provisions of the Morrill Act of 1890, the University receives annually from the United States the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life, and to the facilities for such in-

struction." This Morrill Fund is duplicated by the Nelson Fund, created by the Act of March 4, 1907. The University receives from the same source, for the support of the Agricultural Experiment Station, \$15,000 yearly, from the Hatch Act of 1887, and \$15,000 additional, from the Adams Act of 1906. Fifty-seven sections of valuable pine land in Coconino County have been set apart by the Federal government for the benefit of the University, a small sum being annually received from the leases of this land.

State Appropriations—The appropriations of the Legislature for the biennium 1913-15 were \$163,500 for maintenance; \$20,000 for general improvements; \$165,000 for a fire-proof agricultural building; \$28,900 for current expenses of the Experiment Station; and \$30,000 for a new experiment farm in Salt River Valley.

Gifts and Endowment—The endowment of \$5,000 granted in 1911 by the El Paso and Southwestern Railroad for the use of the Agricultural Experiment Station in carrying on hydrographic work in Sulphur Spring Valley still affords means for continuing these studies, in cooperation with property owners of the Valley.

The Southern Pacific Company has contributed \$2,000 for the work of the Experiment Station in the Sulphur Spring Valley.

By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, the sum of \$10,000, the income from which is to be annually applied for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the Department of Mineralogy and School of Mines of the University of Arizona. The fund thus created has been named the Douglas Endowment Fund.

The University also receives annually a small amount from miscellaneous sources such as matriculation, tuition, and dormitory fees.

## HISTORY

The Act of Legislative Assembly making possible the University of Arizona was passed in 1885. By 1890 three of the departments for which it provided, the Agricultural Experiment Station, the College of Agriculture, and the College of Mines and Engineering, were organized, and in 1891 the University was opened to students. The history of the University of Arizona for the first twenty-three years of its existence has been closely related to the educational history of the State. When it was opened in October, 1891, with a faculty of eight professors and instructors, only thirty-one students, all told,

matriculated, and only nine of these were of Freshman rank; the remaining twenty-two were taken care of in a Preparatory Department. For the first eighteen years the preparatory students outnumbered the University students. But in order to encourage the growth of high schools throughout the State, the University refused to admit to its Preparatory Department, students coming from communities large enough to support local high schools. By 1911 the State was so well provided with such schools that the University announced its intention of closing the Preparatory Department by withdrawing each year the work of the lowest class of the preceding year. The first step towards the execution of this policy was taken in 1912-13, and in June, 1915, the permanent closing of the Preparatory Department was effected.

The increase in the number of college students has been more than sufficient to offset the decrease in the number of preparatory students. The membership of the University proper has shown a steady, normal growth gratifying in a pioneer state, in which the industrial basis that makes the privilege of higher education a matter of course, is still in process of establishment. To secure this growth and develop a University worthy to rank among older State Universities and competent to offer to the youth of the Commonwealth just educational advantages, Arizona has been obliged rapidly to expand and enrich the various departments of instruction in the University, and to that end has provided a faculty and academic equipment of high order for a College of Letters, Arts, and Sciences, a College of Mines and Engineering, and a College of Agriculture.

## LOCATION AND CLIMATE

General Statement—The University of Arizona is situated at Tucson, a city of eighteen thousand inhabitants, on the main lines of the Southern Pacific Railway, and the El Paso and Southwestern System, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad valley at an elevation of 2,400 feet above sea level and is surrounded by mountains.

Advantages of Location for Students of Engineering—Because of its situation in the neighborhood of great mines, the University offers exceptional advantages to the students of mining engineering through the opportunity it affords them of seeing the actual operation of mines and the development of great enterprises, while carrying on the theoretical and experimental work of the mining

course. As Tucson is a railroad center of some importance and the engineering headquarters for several lines of the Southern Pacific system, the students of civil engineering also are provided with a field for observation and vacation employment.

**Advantages of Location for Students of Agriculture**—The situation of the University is favorable for students of agriculture as well as for students of engineering. Tucson has many irrigated farms in its neighborhood, is near the great range country of Southern Arizona, and occupies a central position with relation to the agricultural activities of the State. The University has kept pace with the growing interest and investment in agriculture in the State and has adapted its instruction and research in this science to the special needs of the State.

**Advantages of Location for Students of Astronomy**—In natural advantages the University, with all Southern Arizona, is even more highly favored by a climate which is perhaps the best in the United States for astronomical observations. The fine weather day after day, the quietness of the air at night, and the freedom of the winters from snow, all contribute to a consecutiveness of observation day by day such as is found practically nowhere else, and to a perfection of the atmospheric conditions that renders the most exacting work possible.

**Climatic Advantages**—The situation of the University is fortunate not only by reason of its adaptation to these lines of work but also because of the advantages it offers from the point of view of general wellbeing. Its dry, mild, and equable climate has made Tucson a winter resort unsurpassed for healthfulness. Little rain falls during the winter; fogs are all but unknown; cloudy days are rare. The percentage of sunshine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states. The total amount of rainfall for the year averages less than twelve inches, half of which comes in the months of July, August, and September. These advantages insure to students a comfortable education and a wide range of out-door recreations throughout the college year.

## GROUND

The University Campus, consisting of sixty acres, is situated upon high ground about a mile from the business center of Tucson with which it is connected by an electric car line. On every side it com-



mands a view of mountain scenery of remarkable extent and grandeur. Carefully laid out in drives, lawns, and gardens, with a large number of palms, olive, ash, umbrella, pepper, bagota, and cottonwood trees the Campus has the air of a well kept park.

An abundant supply of good water for household, laboratory, and irrigation purposes is drawn from a large well on the Campus from a depth of one hundred and twenty feet, thus securing immunity from the dangers of a contaminated water supply. The Campus has a complete sewer system connecting the buildings with the city mains at the University gate. The buildings are lighted by electricity.

## BUILDINGS

University Hall, the oldest of the University buildings, contains recitation rooms, laboratories and apparatus rooms of various departments, and an assembly room.

The Library, a structure of red brick and Bedford sandstone, contains the library reading room, the stack rooms, work rooms for the library; departmental conference rooms; and room for the Department of Geology.

Science Hall, a building of architecture harmonious with the Library, which it faces, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the third to chemistry, biology, and civil engineering. A superstructure on the roof is used as an astronomical observatory.

Agriculture Hall, a commodious new building of brick and reinforced concrete, provides temporary administration offices, and permanent quarters for the University Museum, the College of Agriculture, and the Department of Home Economics.

The Shop and Assay Building contains well equipped class-rooms, laboratories, shops, and instrument rooms for various departments of engineering.

The Mill or Mining Machinery Building is a plain wooden structure equipped with stamp mills, jigs, concentrating tables, separators, and other machinery necessary for the mining laboratory.

The Mechanical and Electrical Laboratory houses the equipment for the Mechanical and Electrical Engineering Departments in addition to the fire and service pumps, and boilers for heating and experimental purposes.

Music Hall provides music rooms and recitation rooms for the Departments of Music and Art.



Herring Hall, the gymnasium, 40 x 80 feet in size, is the gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The Auditorium, having a seating capacity of five hundred, accommodates University meetings and student assemblies. Its stage, when opened on the patio between the wings of Agriculture Hall, completes an open air theatre seating about twelve hundred.

The President's House is situated at the west end of the north drive.

Pima Hall and West Cottage provide dormitory accommodations for about forty women. Each hall has its parlor, living rooms, modern sanitary equipment, and sleeping-porches.

Arizona Hall and South Hall provide dormitory accommodations for about one hundred men. Both halls are admirably suited to their purpose and in addition to the customary equipment, provide spacious sleeping-porches.

The Dining Hall provides boarding accommodations for all persons living on the Campus.

## GENERAL EQUIPMENT

### THE UNIVERSITY LIBRARY

Books—The books of all departments of the University are assembled in a central Library containing 22,500 bound volumes exclusive of public documents, and several thousand unbound bulletins and reports. The present appropriations provide for an annual increase of about 1,200 volumes. Since nearly one-half of the total accessions have been made within the last five years, the books have, as a whole, a direct bearing upon the college work now offered. A collection of complete sets of scientific and literary periodicals, to which additions are made yearly, is of special service to those interested in research.

Documents—The Library is a regular depository of United States documents; these publications have been placed in a separate room where they are arranged by departments. The Library has recently acquired, partly through private donations, much of the material catalogued in the card indexes issued by the Department of Agriculture of the United States.

Periodicals—The Library subscribes for some 200 periodicals and papers for use in the Reading Room.

**Classification and Catalogues**—The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary card catalogue of authors, subjects, and titles in one alphabetical arrangement. Printed cards from the Library of Congress are used, supplemented by typewritten cards for books reported as not in their stock.

The Library has recently added to its catalogue the U. S. card indexes issued by the Department of Agriculture. In 1913 the University issued a sixty-page catalogue of material on Arizona in possession of the University Library entitled, *A Bibliographical List of Books, Pamphlets, and Articles on Arizona in the University of Arizona Library*.

**Withdrawal of Books**—Any book, with the exception of periodicals and books reserved for reference, may be drawn for home use by any person connected with the University, and the use of the Library for reference purposes is extended to the general public as well.

**Reading Room**—Some 200 current periodicals and papers, and 600 reference books—encyclopedias, dictionaries, periodical guides, etc., are in readiness for convenient reference in the Reading Room.

**Hours**—The Library is open 12 hours on week days during the academic year, with the exception of Fridays and Saturdays, when a somewhat shorter schedule is observed.

**Correspondence and Loans**—Reference work for teachers and students throughout the State is gladly undertaken by correspondence. Loans of books will also be made to teachers and others engaged in systematic study in so far as the grant is not precluded by the need of the material at the University.

**Course in Bibliography**—The Librarian offers a general course in the use of books, elementary bibliography, and library administration, open to all students.

## THE MUSEUM

The collections now displayed at the University Museum comprise representative series of minerals, ores, and rocks of Arizona; noteworthy among these are superb specimens from the mines of the Copper Queen Mining Company at Bisbee. There are also collections of typical rocks and materials for comparison, and many specimens of ores from different parts of the United States and from abroad. It is desired to make the collection of ores and minerals fully represent the great mineral resources of Arizona.

The Museum is indebted to the late Mr. Herbert Brown, for a large and valuable collection of skins of the birds of Arizona; for a collection of ancient aboriginal pottery and other relics; and for the fossil skull and teeth of an elephant, and other fragmentary remains of extinct animals, sent from Yuma.

The Museum has been made the custodian of a collection of arms and military relics, chiefly from the Philippine Islands, deposited by Captain Charles C. Smith, of Fort Huachuca, Arizona.

Historical records of much value are gradually accumulating as a part of the Museum, and an appeal is made to old settlers and others to bear this fact in mind when making disposition of articles bearing even remote relation to the early pioneers and this history. All records and data of any nature that can be gleaned are worthy of preservation, and it is earnestly desired to have them placed at the University, where they will always be accessible for reference.

## DEPARTMENTAL EQUIPMENT

### AGRICULTURE

The Agriculture building is a three-story reinforced concrete and brick building, with a large basement excavation and with a recessed roof suitable for open air laboratories, farmers' short course dormitories, and for social occasions. This building provides office room, class rooms, research laboratories, students' laboratories, library, museum and study rooms, and auditorium facilities, in which to conduct the agricultural activities of the institution, and, incidentally, to provide, to some extent, for the needs of other overcrowded departments of work. Technical facilities have been provided in the building for work in irrigation, plant breeding, horticulture, chemistry, animal husbandry, agronomy, and agricultural extension service, together with further space designed for the accommodation of other scientific departments that may be developed in time to come. This building, large, well planned, and architecturally beautiful, is adequate for the accommodation of a considerable number of agricultural students, and, together with other facilities provided, will attract these students in increasing numbers.

The University Farm consists of eighty acres of Rillito Valley land and is situated three and a quarter miles from the University campus, being connected with the campus by automobile service for the convenience of instructors and students. Thus far about thirty-five acres have been cleared and leveled. Of this area twenty-five and one-half acres are in alfalfa; seven acres are in gardens, and eight acres are used for the production of such forage crops as milo maize,

oats, barley, etc. The tract is irrigated from a reinforced concrete well fitted with a 15 H. P. distillate engine and a No. 5 Krogh centrifugal pump. The distributing system consists of a 12" cement tile. The buildings consist of a fire-proof machinery shed and pump house with work rooms and basement cellar. A horse barn, a dairy barn, a milk house, a water tank, and three cottages for the foreman and the workmen, complete the equipment of buildings.

A poultry plant, occupying five acres of the eastern extension to the campus, is in process of development. A flock of fourteen ostriches is a novel and attractive feature of this plant.

Greenhouses and gardens located upon the University campus afford additional facilities for class work in agriculture. The campus itself contains many ornamental trees, shrubs, and flowers adapted to the climate of the region and furnishing material for the study of landscape gardening.

A good collection of Agricultural and Horticultural works, including encyclopaedias, standard texts and Experiment Station bulletins, is contained in the University Library. Several sets of herd books for use in connection with livestock studies are also in the Library.

The publications of the Agricultural Experiment Station, including bulletins, reports, and *Timely Hints for Farmers*, are of special educational value in connection with Southwestern agriculture. These publications are available, not only to college classes, but are distributed to school organizations of all kinds needing them in their course of study, and to a mailing list of farmers and others interested in Southwestern agriculture, which now numbers about 10,000 names.

The Agricultural Experiment Station equipment of cultural stations affords opportunities to students in agriculture, for observation and study. The class in dry farming, for instance, has this year visited and studied operations conducted at the Sulphur Spring Valley Dry Farm, which is within convenient reach of the University grounds. It is planned to stipulate in the future that students shall do vacation work in residence upon these stations, as a requirement for graduation.

The Farmers' Short Course is now an established institution and the Demonstration Train reaches many thousands of interested observers each year.

## ART

For use in the courses in the History of Painting, a good collection of standard reference books is available in the University



Library, together with appropriate maps; also a large number of foreign photographs, Seeman colored reproductions, and Elson prints. Recently a representative collection of plaster casts has been acquired, to be used in teaching the influence of sculpture on painting.

#### ASTRONOMY

For Astronomy an 8-inch Clark lens and mounting, both of the finest quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are erected on a cement pier supported on the main walls of the Science building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, belonging to the University, sidereal and mean time clocks, and pier for latitude and longitude observation.

In order to obtain continuous records of the sun's heat falling upon this region, the department has a Callendar Sunshine Receiver connected to a Leeds and Northrup recording galvanometer. This mechanism has been running since October 9, 1913. For correcting its results a Smithsonian Silver Disk Pyrheliometer has been purchased.

#### BIOLOGY

The Biological laboratories occupy a convenient and well lighted suite of eight rooms, and have equipment suited to modern instruction and research in the biological sciences, to the region, and to the courses offered.

The herbarium consists of 50,000 mounted specimens, of which 20,000 sheets are in the Arizona botanical survey collection. There are also 6,000 sheets in the herbarium of cultivated plants. The building up of these collections is progressing rapidly, largely by virtue of the work on the botanical survey of the State, which is being conducted by the Department of Biology, and which will result ultimately in the publication of a *Flora of Arizona*. The unique flora and fauna of the mountains, foothills, mesa, and river valley collecting grounds, in close proximity to the institution, offer attractive opportunities for instruction and research, particularly along taxonomic and ecological lines.

There are articulate and inarticulate skeletons, plaster and papier mache models of the more important structures of the human anatomy, and duplicate material for study and dissection. The department has twenty-six compound microscopes of Spencer, Bausch and Lomb, and Leitz types, a Leitz binocular microscope, Leitz rotary microtome, photographic apparatus, stereopticon, electric thermostats, centrifuge,



spirometer, caloriscopes, electric apparatus including inductorium and rheocord for animal physiology, and also apparatus for plant physiology.

The Desert Botanical Laboratory of the Carnegie Institution located at Tucson is an inspiration for research work in the department and supplements the facilities of the University for botanical investigation, particularly as concerns field plant physiology and plant geography.

#### CHEMISTRY

The chemical equipment used for instruction occupies fourteen rooms in Science Hall.

The laboratory used for the study of general chemistry and qualitative analysis accommodates sixty-five students. It is equipped with the ordinary apparatus for this class of work including a ventilating system of individual down-draft hoods.

The laboratory for quantitative analysis is equipped for the teaching of gravimetric, volumetric, and gasometric analysis, including metallurgical chemistry. The balance room contains fourteen analytical balances of the latest models so arranged as to insure a maximum of stability and accuracy. This room also contains such reference works loaned from the central Library as are useful in connection with the laboratory work.

A lecture and demonstration room fitted with a projection lantern, charts, and special apparatus used in the illustration of the principles of theoretical and practical chemistry, accommodates about forty-five students.

The laboratory of physical chemistry is equipped with the following apparatus: Wanner's optical pyrometer, le Chateliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, Abbé refractometer, large wave length spectroscope made by Adam Hilger, thermostats, polariscopes, and apparatus for conductivity work and the determination of electro-motive force.

One small laboratory is equipped for electro analysis, another for general electric furnace work, and a third for organic synthetic chemistry. The equipment for electric furnace work consists of both arc and resistance furnaces, transformers and motor-generators, vacuum pump for use with vacuum furnaces, and complete outfit for the thermal analysis of metals and alloys. This room is also furnished with gas muffle and crucible furnaces which find use in connection with the work in inorganic preparations.

Two offices and two private laboratories complete the equipment of the department.

The laboratories and equipment offer good facilities for original research and the department encourages such work for those having the necessary preparation.

### CIVIL ENGINEERING

The present quarters of the Department of Civil Engineering are in Science Hall and include an instrument room, an office, a materials testing laboratory, and a drafting room.

The surveying instruments include six transits, four levels, two plane tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used in engineering construction. The apparatus includes an Olsen 100,000-pound universal testing machine, a 3-gang abrasion cylinder, a tensile testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, moist chamber, immersion tanks for cement and concrete specimens, and other auxiliary equipment.

### GEOLOGY

The Department of Geology occupies two rooms in the Library building, one a lecture and drawing room, and the other a laboratory containing drawers for rock and ore specimens. The laboratory possesses a set of the geological folios and topographical maps published by the United States Geological Survey, and a series of rocks and ores supplemented by the collection in the Museum. The equipment further includes a Nachet polarizing microscope, a Leitz metallographic outfit for the study of polished surfaces of ores; a complete outfit for field work, with transit, plane tables, and alidades, as well as barometers, pocket transits, telometer, and pocket levels. The equipment of this laboratory is supplemented by that of Mineralogy and Petrography, and that of Mining and Metallurgy.

Field Work—Opportunity is provided by the Departments of Mining, Metallurgy, and Geology for extensive field work during the academic year. Not only is an excursion of from one to two weeks taken in the spring to one of the important mining and metallurgical districts of Arizona, New Mexico, or Sonora, but for Seniors and special students in mining, frequent trips of one or two days in the

vicinity of Tucson are provided for by a grouping of all day laboratory periods in Mining, Metallurgy, and Geology, toward the latter part of the week.

Briefly, the region consists of deformed Paleozoic and Mesozoic sedimentary rocks, resting on a basement of pre-Cambrian schists and granites, intruded by late Mesozoic or early Tertiary volcanics. The mountains consist of maturely eroded fault blocks, separated by wide, partly waste-filled valleys, which increase in size toward the southwest. Thus, many varied features of geology and physiography are presented, as well as several types of ore deposits, consisting of contact metamorphic deposits, in the Twin Buttes and Silver Bell districts, veins and replacements in connection with the intrusive granitic rocks in the Santa Rita and Patagonia Mountains, and veins in late Tertiary volcanics in the Mammoth district and Tucson Mountains. In the immediate vicinity of Tucson, there are several old mines, formerly large producers, and a great number of smaller mines affording opportunity to study a great variety of mine development and mining methods. There are several concentrating mills in the region and a copper smelter (now idle) twelve miles south of Tucson.

#### HOME ECONOMICS

The south wing of the third floor in Agricultural Hall has been planned for the Department of Home Economics. The three large laboratories, one for cooking and dietetics, the other two for dress-making and millinery, are well lighted and adequately equipped. Each sewing laboratory has a large locker and supply room. The pantry of the cookery laboratory is well furnished and convenient. A model kitchen, butler's pantry, dining room, and bed room are provided. In these homelike rooms all household processes, the cooking and serving of meals, the cleaning and decorating of rooms, and the care of the sick and convalescent, are discussed and carried out.

#### MECHANIC ARTS

The shops and drawing room occupy a total floor area of about 8,000 square feet, divided into a large shop and machinery room, with adjacent tool, supply, and store rooms; draughting, model, pattern, and lecture rooms, and office.

The entire building is well ventilated and lighted from above as well as from the sides and is steam heated.

The wood shop has a full assortment of hand tools, twenty-four benches with a complete set of tools for each, six turning lathes, Beach scroll saw, a Tannewitz dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a Tate Jones hardening furnace, a combination shear and punch, a blacksmith's drill press and a full assortment of small tools and appliances. Blast is furnished by a No. 3 Sturtevant blower; smoke and gases are removed by a 70-inch exhaust fan.

The machine shop contains one 24-inch Lodge and Shipley engine lathe with taper attachment, two 14-inch Lodge and Shipley lathes, one 14-inch Pratt and Whitney lathe with taper attachment, one 12-inch Seneca Falls lathe with taper attachment, draw-in chuck, and English and Metric change gears; one 10-inch Reed speed lathe, one 16-inch Cincinnati shaper, one 24-inch by 6-foot Woodward and Powel planer, one Browne & Sharpe No. 2 Universal milling machine, one Browne & Sharpe No. 1 Universal grinder, one Prentice 24-inch drill press, one 13-inch Slate sensitive drill, one power hack saw, one drill grinder, one emery stand, one grinding attachment for lathes, one 1½-ton portable hoist, one 1-ton triplex hoist, one ½-ton screw hoist. Each shop has its own tool room with small tools, gauges, and measuring instruments.

#### MECHANICAL AND ELECTRICAL ENGINEERING

The Departments of Mechanical Arts and Electrical Engineering possess a comprehensive catalogue file containing the trade literature of about five hundred leading manufacturers of this country, together with a large collection of working drawings, and sample collection of models, machine parts, valves, electrical fittings, insulating materials, and abrasives.

The laboratory is equipped for experimental work in the study and operation of steam boilers, steam and gas engines, hydraulic and electrical machinery. Besides the machinery of the shop and mill which may be used for the study of machine design as well as for experimental work, the University has a 75-horsepower internal furnace marine type boiler, 45-horsepower return tubular boiler, a 5-horsepower vertical experimental boiler, a 35-horsepower Atlas center crank engine, a Chuse high speed automatic side crank engine, direct connected to 50 k. w. alternator, a 30-horsepower Fort Scott engine, a 10 x 7 x 10 Worthington duplex direct-acting steam pump, a small duplex pump, a small Cameron boiler feed pump, a 4" centrifugal pump, a 3½" two stage centrifugal pump, a 6" Venturi meter, an injector, a 40-horsepower Fairbanks Morse gasoline engine direct connected to a 500-gallon high pressure fire pump, a 23 k. w. Crocker Wheeler direct current generator, a 5 k. w. Fort Wayne rotary convertor, a 15-horsepower Wagner



variable-speed induction motor, a 7-horsepower Westinghouse induction motor, a 7 k. w. Westinghouse direct-current generator, direct connected to a four-cylinder gasoline engine, a 3-horsepower and a  $\frac{1}{2}$ -horsepower direct-current motor, a 5 k. w. Packard variable voltage transformer, two small testing transformers, and, for measuring instruments, two graphic recording volt meters and ammeters, several integrating watt-meters, and a series of indicating meters. An 8" x 10" triplex pump with its electric motor serves as part of the equipment of the laboratory, and furnishes the University with its water supply. The department is equipped with steam indicators, gauges, weighing scales, and apparatus for testing fuels and flue gases. For the testing of pumping machinery a large steel box overflowing into cement cistern is connected by suitable piping to the various pumps in the laboratory.

#### METALLURGY

The Mill or Metallurgical Laboratory tests the adaptability of ores for treatment by different processes both on a large and small scale.

The chief features of the equipment are a Blake crusher, 4-in. by 7-in.; a Dodge crusher, 4-in. by 6-in.; sampling rolls, 6-in. by 9-in.; a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lightning crusher and a disc pulverizer; a 5-stamp mill, with 800-pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamation plates for the same; a 2-ft. clean-up pan; a 1-ft. amalgamation pan, and a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table, and a Hallett hand jig; a  $1\frac{1}{2}$ -ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; 3-ft. agitator; a 12-in. 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturtevant shaking screen; a Tullock ore feeder; a belt and bucket elevator, sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

The power for operating the plant is furnished by a 30 H. P. Westinghouse induction motor, type C.

The Callow Miniature Plant has been recently added, consisting of, a small two-compartment Harz jig, a small Wilfley table, a canvas slime table an algamating plate, a set of hydraulic classifiers, a set of cyanide agitators, an automatic feeder. This plant is driven by a  $\frac{1}{8}$  H. P. motor and stands on a hopper bottom tank



divided into three compartments. It is a complete ore dressing plant, gold mill, and, together with the cyanide percolators described elsewhere—cyanide mill, and tests quantities of ore ranging in amounts from twenty-five to four hundred pounds. The results from these tests should predict the performance of a full size plant. There are also a Richards' pulsator jig, a Richards' pulsator classifier, and an International dry concentrator.

In the assay laboratory there are assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam, fired with coke, gasoline, and gas, so the student becomes trained in the use of all these fuels; all needed appliances for assaying by dry and wet methods; desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores, in mineral fertilizers, and in qualitative tests of minerals.

#### MILITARY SCIENCE AND TACTICS

An armory is fitted with the necessary gun racks and accessories. The equipment includes one hundred Krag cadet rifles with complete accoutrements, four model 1906 Springfield chambered for .22 for indoor practice, twelve sabres and belts, musical instruments for the band, signal flags, eighteen new Springfield rifles, and targets for short range practice.

Annual encampment is held at a location approved by University authorities. The mess outfit is provided by the University and the meals of cadets while in camp are under the direction of the University Quartermaster.

#### MINERALOGY AND PETROGRAPHY

There are two laboratories for Mineralogy, one being used for microscopic work in Petrography and the other for blowpipe analysis and determinative Mineralogy. The laboratory for microscopic work contains seven petrographic microscopes including both American and foreign makes, Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin section corresponding, one hundred and twenty oriented sections of minerals, and apparatus for photomicrography and projection. The laboratory for blowpipe analysis is supplied with minerals for making the necessary tests and studying the physical properties. A type set of six hundred minerals classified according to Dana is included. For the study of crystallography, there are, a collection of three hundred pasteboard models

of crystals, numerous glass and wooden models, several two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer of the most recent type, apparatus for projection and drawing of crystals, and a model machine for cutting crystals from plaster of Paris.

### MINING ENGINEERING

The laboratory for the practical study of Mining Engineering is attached to the mill building.

The equipment of the mining laboratory includes an assortment of hand and machine tools, and all apparatus for testing purposes; a WG3 8 x 8 Sullivan belt driven compressor, with 30 x 6 pressure tank; a FF12 Sullivan 2½ Lite Weight drill with tripod; a DC19 jack hammer drill, Sullivan type; a Waugh drifting drill; a Chicago stoper; a 40G Cleveland stoper; a No. 1 Model V Murphy block hold drill; a 2½" Pacific rock drill, with clamp and column; a 3" Leyner Model 5 slugger, with tripod; a Flottman hammer with clamps and columns; a 4E Temple Ingersoll electric air drill, with clamp and column; a Rogers 3" rock drill, with tripod; a 12A Waugh stoper; a 2½" Wood drill, with clamp and column; a McKiernan Terry jack hammer drill; a large assortment of hose of various kinds and makes, and steel; lighting devices and miners' lamps, candlesticks, acetylene lamps, electric mine lamps; a double inlet Sirroco fan, a model Connellsville involute blower, a 3½" Acme blower, and a 12" Typhoon blower.

Pumping and drainage are illustrated by a 6 x 24 Fernier sand pump; a Cameron model pump, a 4" type EE American centrifugal pump; a 5½ x 2⅛ x 3 Blake pump; 1" Class O Buffalo centrifugal pump; a model Connellsville cycloidal pump; a 3 x 2 x 3 Dow steam pump; a 1" Dow centrifugal pump; a 3 x 2 x 4 Dean Bros. steam pump; an Edison 8 ft. trench pump; a type N Kingsford centrifugal pump; a 2" Krogh vertical centrifugal pump; and a 5¼ x 3½ x 5 Worthington steam pump.

The sharpening department is equipped with a Buffalo forge, with a No. 3 Leyner oil forge, with anvil and complete assortment of tools.

The timbering framing department is equipped with tools, and with a large number of models showing the construction of underground timber, as well as head frames, ore bins, etc., above ground.

The particularly advantageous location of the College of Mines allows the extensive use of the field as a laboratory and practical work in preference to laboratory work on a smaller scale.

## MUSIC

Music Hall is equipped with studios for instruction in voice, piano, and stringed and wind instruments. Practice rooms are to be found off the campus.

## PHYSICS

The department of physics has facilities for the demonstration of all important phenomena. A lecture room seating forty persons is fitted with lights, water, gas, heliostat, alternating and direct currents of great range, an opaque projection lantern, elevated seats, and shutters for darkening the room. Two large main laboratory rooms supply space for mechanical and electrical work, while special rooms are devoted to heat, sound, light, magnetism, and research work. A carpenter's shop, a repair and store room, a photographic dark and enlarging room, a constant-temperature room are provided. A pendulum seismograph is to be installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. There are also a large Oudin resonator and a mercury interrupter, manufactured by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Hon. Mark J. Egan, of Clifton, the University has a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. The department possesses also a Knott wireless outfit of  $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles; three motor generator sets, the largest having an output of 7 kilowatts; a Leeds and Northrup potentiometer and accessories; a Carey Foster low resistance bridge; a Leeds and Northrup recording galvanometer and bridge with various resistance thermometer bulbs; and very complete apparatus for showing electro-magnetic phenomena, rotary fields, and stationary electric waves, polarization, etc.

## PHYSICAL TRAINING

Gymnasium—Herring Hall, the Gymnasium, is well supplied with standard apparatus such as chestweights, dumb-bells, barbells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jumping and vaulting stands, fencing foils and masks, basket balls and goals, five large mats, and a set of

anthropometric apparatus. In the basement are one hundred and forty-four lockers, and five shower baths supplied with hot water from a heater with large reservoir.

**Outdoor Equipment**—The outdoor equipment consists of two baseball fields; a quarter-mile track with a 120-yard straightaway; five tennis courts; a football field, and a basketball court for girls. A new athletic field of six acres, adjoining the gymnasium, will soon be completed.

## STUDENT RESPONSIBILITIES AND ACCOMMODATIONS

**Student Body Organization**—The students are organized under the above title for the purpose of carrying on all student enterprises with the cooperation and under the supervision of a faculty committee. The organization has a carefully drawn constitution, a President, Vice-President, Secretary, and Treasurer. The Treasurer handles all student funds for athletics and other purposes and is required to give a suitable bond. Much of the business of the organization is carried on in a House of Representatives which meets twice a month and to which two faculty members belong.

**Discipline**—The policy of the University in all its departments is based upon the assumption that students come to the institution with a determination to utilize the opportunities offered, and with a keen sense of duty, honor, and courtesy to each other and to the faculty.

**Dormitories**—Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, accommodating about sixty-five students, two in a room, and in Arizona Hall, accommodating forty students; Pima Hall and West Cottage provide accommodations for forty young women, under competent supervision. All dormitories are lighted by electricity. Rooms contain a clothes press, single bedstead, tables, chairs, mirror. Students supply their own mattresses, pillows, sheets, blankets, towels, rugs, brooms, laundry bags, and such articles as they may desire for ornamenting their rooms. They care for their own rooms under the direction of the head of each dormitory.

**Residence off the Campus**—The residence of students off the campus, so far as these students are not living in their own homes, is subject to the approval of the University authorities.



The Dining Hall—The Dining Hall of the University is under the management of a trained dietician who is responsible to the President and the Board of Regents. It is the aim of the University to serve substantial, wholesome, appetizing meals at cost. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside of the dormitories may board at the Dining Hall with permission of the President. Board is payable in advance on the first of each month.

## EXPENSES AND FEES

Tuition—The University of Arizona requires no general tuition fee of students who are legal residents of the State of Arizona, and there is no charge for instruction except in the Department of Music. Students who are non-residents of the State pay a tuition fee of \$15 each semester.

Incidental Fee—An incidental fee of \$10 is payable annually by all students on the day of registration, \$5 of which is credited by the University to the Student Activities Fund. On the incidental fee there is no rebate if for any reason a student is compelled to leave the University, the amounts collected having already been either expended in cost of registration or distributed to the individual student enterprises.

Board and Room—Board and room on the campus are charged for at the rate of \$23 per month.

Cadets' Uniforms—Members of the cadet companies are required to provide themselves with the prescribed uniforms which will be ordered by the University. A deposit of \$12 in payment for uniforms is required at the time of registration of all male Freshmen and Sophomore students.

Encampment Expense—The cadets will also pay the cost of their transportation to the annual encampment amounting to about \$5. Students who are members of the cadet companies and do not live on the campus are charged \$4 for their board during the period of encampment.

Laboratory Fees—In certain laboratory courses deposits are required as security for the payment of the cost of breakage and material supplied. A statement of the amount of such deposits may be found in connection with the announcement of courses. Any balances remaining in these funds are returned to the students upon the completion of such courses.



Checks and postoffice or express money orders should be made payable to the University of Arizona.

### ASSISTANCE TO STUDENTS

**Self-Support**—Various positions about the grounds, buildings, and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting. The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, able to do this outside work and at the same time maintain a good record as students.

**The Students' Loan Fund**—The Students' Loan Fund gives temporary assistance to deserving students, men or women. The conditions under which loans are made may be ascertained on inquiry of the President of the University.

### SCHOLARSHIPS

**County Scholarships**—By Act of the Legislature a scholarship in the University is granted to each county of the State, to be assigned to that student who passes the best examination set by the University. The examination is under the supervision of the County School Superintendent and is held in the month of June. The papers are read at the University, the President certifies the results to the County Superintendent and to the successful candidate.

Candidates for county scholarships are examined upon the following subjects: English, algebra, science (either agriculture, botany, zoology, physics, chemistry, or physical geography); and two other subjects (chosen from history, Latin, French, German, Spanish, or a second science). The examination is restricted to five subjects.

The scholarship amounts to \$150 a year and is payable by the State direct to the University, to be applied on the student's bill for board, room, incidental, and other fees.

The scholarship is good for one year at the University and is to be held during the student's Freshman year, except that when a given county offers no candidate for the Freshman class, a candidate for admission to a higher class in the institution may apply for the qualifying examination and if successful, secure the scholarship.

**The Bennett Scholarship**—The Philo Sherman Bennett scholarship is endowed by the gift of \$500 to the University in 1905, through the agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

The Collegiate Club Scholarship—The Collegiate Club of Tucson has for several years given a scholarship stipend of \$50 to aid in the education of some young woman recommended by a committee of faculty members of the Collegiate Club.

The State Federation of Clubs Scholarship—The State Federation of Clubs not infrequently makes a University student the beneficiary of one of its scholarships.

#### **BUREAU OF RECOMMENDATION**

The University of Arizona maintains a Bureau of Recommendations for the purpose of helping deserving students and graduates who have received their training at the University of Arizona, to secure desirable positions, and of leading employers to find well prepared and efficient workers. No registration fee is charged, and the bureau, without expense to the candidate, forwards to those interested in his application confidential information which it has collected concerning him. All students desiring to register with the bureau will consult the Chairman.

## ADMISSION

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### GENERAL REQUIREMENTS APPLYING TO ALL NEW STUDENTS

**Age**—All applicants for admission to the University must be at least sixteen years of age.

**Character**—All new students are required to furnish satisfactory evidence of good character, and certificate of graduation or of honorable dismissal from the school last attended.

**Health**—All new students at the time of registration shall submit a statement, signed by a reputable physician, certifying to good health or to such disability as will in any way affect the student's University work or his membership in the University.

#### REQUIREMENTS FOR ADMISSION TO FRESHMAN RANK

All applicants for admission to Freshman rank in the University are expected to have completed the equivalent of a four-year high school course including the work indicated by the fifteen credits specified below:

English .....	3	Physics, Chemistry, or Biology .....	1
Algebra .....	1½	Latin, Greek, French, German, or Spanish.....	2
Plane Geometry .....	1	Electives .....	5½
History and Civics.....	1		

A credit is understood to stand for one study pursued satisfactorily five times a week for one year.

All departments of the University require fifteen credits for admission.

All departments excepting the College of Agriculture require the distribution of credits called for above. This college differs from the other departments in its requirements in one point only. For admission to the four-year course in agriculture, a student may substitute two elective units for the two years of a foreign language. Such a student is, however, required to take two years of a foreign language instead of one for graduation from the University.

## SCOPE OF THE ADMISSION REQUIREMENTS

## ENGLISH

*English*—3 credits. (a) English Composition. The candidate should have the ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs. (b) English Classics. The classics to be studied in preparation for college English are divided into two classes, those intended for thorough study and those intended for general reading. Preparation in the former class should cover subject matter, form, and structure, and the leading facts in those periods of English literary history to which the prescribed books belong. In the latter class, the student should secure general knowledge of the subject matter, and of the lives of the authors. In exceptional cases an equivalent amount of reading and study in other than prescribed works will be accepted as a substitute.

For thorough study, for 1915. Shakespeare's *Macbeth*, Milton's *Comus*, *L'Allegro*, and *Il Penseroso*; Burke's *Speech on Conciliation with America*, or Washington's *Farewell Address*, and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-IV of College Entrance Requirements in English for 1914-1915.

## MATHEMATICS

*Algebra*—1½ credits. The work required in algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportions, etc., as given in standard texts, such as Hawkes, Luby and Touton, *Complete School Algebra*, or Slaughter and Lennes.

*Plane Geometry*—1 credit for a year of work. The requirement is based upon the work outlined in text-books such as Wentworth and Smith's *Geometry*, with special reference to original exercises and notebook work.

*Solid Geometry*—½ credit for a half year of work. Original exercises and notebook work are required.

## HISTORY

To meet the requirements in history the student should have acquired a knowledge of events as presented in any of the standard text-books. There is required further an interpretation and analysis of

these events, which includes an understanding of the causes and results of any movement, and an appreciation of the various influences acting in the development of an institution.

Ancient History, to the year 800 A. D.—1 credit.

Mediaeval and Modern History of Europe—1 credit.

History of England—1 credit.

History and Government of the United States—1 credit.

## LANGUAGES

\**Greek*—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

\**Latin*—2, 3, or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; sight reading; *Caesar*, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero, and Gellius; Daniell's or Bennett's *Prose Composition*.

\**German*—2 credits. Two years of high school work to cover the following texts or their equivalent: P. V. Bacon's *German Grammar*, Storm's *Immensee*, von Hillern's *Hoher als die Kirche*, Meyer-Foerster's *Karl Heinrich*, Schiller's *Wilhelm Tell*.

\**French*—2 credits. Two years of high school work, covering the following texts, or an equivalent: Frazer and Squair, *French Grammar*, (Part I), with additional drill on the irregular verbs; Aldrich and Foster, *French Reader*; Labiche and Martin, *La Poudre aux Yeux*; Halévy, *L'Abbé Constantin*; Merimeé, *Colomba*; Lamartine, *Graziella*.

\**Spanish*—2 credits. Two years of high school work, covering the following texts, or an equivalent: Coester, *Spanish Grammar*; Turrell, *Spanish Reader*; Alarcón, *El Capitán Veneno*; Galdós, *Mariñela*; Valdés, *La Hermana San Sulpicio*; Valera, *Pépita Jiménez*.

## SCIENCE

*Physical Geography*—1 credit or ½ credit. A year or half-year of work should include the principles of the subject, as treated in the best recent text-books, field, and laboratory study, and the interpretation and steady use of topographic and weather maps and charts.

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\*The courses offered should include the texts outlined, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.



This subject may be combined in half-credits with physiology, which may in its turn be offered as a full credit if it is so desired.

*Botany*—1 credit or  $\frac{1}{2}$  credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work. Botany as a half-credit may be combined with a half-credit in zoology for a full credit or year's work in biology.

*Chemistry*—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, should include the more common metals and non-metals, and their compounds. A careful record of laboratory experiments should be kept.

*Physics*—1 credit. Along with the use of one of the standard textbooks the year's course should include continuous and systematic laboratory practice, recorded in a notebook.

#### ELECTIVES

The electives offered for admission should be chosen from the subjects named above or any other subjects ordinarily taught in high schools and accepted by colleges and universities of standing, with the following restrictions:

Credit to the extent of one unit each may be allowed in, music, freehand drawing, mechanical drawing, shop work, home economics, stenography, typewriting, and bookkeeping, or two units may be allowed for stenography including typewriting. Credits in other subjects may be presented for the consideration of the Registration Committee.

#### METHODS AND CONDITIONS OF ADMISSION TO FRESHMAN RANK

Admission on Certificate—Since the Statutes of Arizona provide that the course of study in the high schools of the State "shall be such as, when completed, shall prepare its students for admission into the State University," the University admits without examination graduates of approved high schools of Arizona. They are the high schools of Bisbee, Clifton, Douglas, Glendale, Globe, Jerome, Mesa, Phoenix, Prescott, Tempe, Thatcher, Tucson, Willcox, Winslow, Yuma. The Tombstone High School, the Nogales High School, and the academies at Snowflake and St. Johns, are accredited for such a part of the preparatory work as they give. The normal schools at Tempe and Flagstaff are among the fully accredited schools. Diplomas or corresponding credentials from high schools and preparatory

schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials.

**Admission by Examination**—Students lacking satisfactory credentials will be examined on the work required for admission, on the first two days set aside for registration. Application for such examinations should be made at least two weeks before the date for the entrance examinations.

**Admission with Deficiency in Preparation**—A student deficient in two units of the work required for admission will be accepted as a conditioned Freshman.

**Time for Removal of Entrance Deficiencies**—All entrance deficiencies must be removed not later than the beginning of the Junior year.

**Manner of Removal of Entrance Deficiencies**—An entrance deficiency may be removed by examination, or if the deficiency is in other than required work, by transfer of college credit to entrance credit on the basis of six units of college work, three hours a week for a year, to one entrance credit, five hours a week for a year.

#### **ADMISSION TO ADVANCED STANDING**

**From Other Colleges**—Students coming from other institutions of recognized standing are admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited in the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

**Entrance Requirements of Students Admitted to Advanced Standing from Institutions of Equivalent Rank**—Students who have had one or more years of work at an institution of equivalent rank to the University of Arizona and who have satisfied the entrance requirements of that institution will be given full entrance standing.

**Credit for High School Work in Excess of Entrance Requirements**—Advance credit is not allowed for excess preparation gained in high school, unless such excess represents equivalent work given in the University. Students having an excess of two years of one foreign language in an accredited high school may receive credit for one year of college work in that subject, without examination.

A student having a credit in Trigonometry not used for entrance, may waive a requirement of three units in college mathematics upon passing a satisfactory examination in that subject.

Admission from Arizona Normal Schools—Graduates of the two-year and five-year courses in the Tempe and Flagstaff Normal Schools, are given a total credit of 30 units in the University, which shall not cancel requirements in English 1, 2, nor any entrance requirement, the equivalent of which shall not have been fulfilled.

#### ADMISSION OF SPECIAL STUDENTS

Students over twenty-one years of age, or those who have clearly defined needs which are not served to the best advantage by any of the regular courses, may be admitted as special students. A student cannot become a special student merely for the purpose of avoiding some college requirement. Before a student may be classified as a special student he must: first, present to the Registrar, President, or Committee on Registration a written statement giving reason for his wishing to take a special course; second, if a minor, present the written consent of the parent or guardian. A student who has been accepted as a special student may elect any course offered, subject to the approval of the instructor in charge. A special student, twenty-five years of age, may, by permission of the faculty, become a candidate for a degree subject to the fulfillment of such requirements regarding entrance work as may be determined by the faculty.

It is expected that those who desire thus to specialize in Mineralogy, Assaying, Geology, or Surveying, will have had at least a high school education, or its equivalent, particularly in English, algebra, geometry, physics, and chemistry.

## REGISTRATION

**Qualifications**—All facilities and privileges of the University are open to properly qualified persons of both sexes. The qualifications in age, character, health, and scholarship required for registration are stated on pages 40-45.

**Time and Place**—All students are required to register on registration days at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated for the purpose.

**Penalty for Late Registration**—For late registration a fee of \$1 will be charged for the first day, and twenty-five cents for each day thereafter, until a maximum of \$2 is reached.

**Presentation of Credentials**—Students entering from other institutions should present to the Registrar certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal, and a copy of the school catalogue or course of study in order to facilitate registration.

**Fees**—An incidental fee of \$10 is payable annually by all students on the day of registration. For other fees and deposits payable at the opening of the year see page 37.

**Required Subjects**—All male students are required to register for Military Tactics for the first four semesters of college work.

Physical training is required for women throughout the Freshman and Sophomore years.

Each student must register for the required subjects of his course in so far as possible in the year for which they are prescribed.

**Elective Subjects**—Entering students may not elect work in excess of the number of units recommended in the course for which they register. Petitions to elect work in excess of number of units recommended in the course for which a student registers, will be considered only when presented by students whose capacity for work has been demonstrated to the satisfaction of the faculty.

Before making choice of elective subjects, the student should in every case confer with the instructors concerned, and with the Registrar.

**Changes in Registration**—After registration no change in classes may be made without the consent of the Committee on Registration. After the first week of the student's attendance upon the University, his registration will be regarded as fixed, and requests for change will be granted only under unusual circumstances.

## GENERAL REGULATIONS AFFECTING REGISTERED STUDENTS

**Attendance**—A student having registered for a course, is required to attend all resulting appointments regularly. A student is responsible to the instructor in charge of the course for absence from such appointments.

**Absence before and after Holidays**—Students absent without excuse on the day before or after holidays will not be permitted to take the regular examinations at the end of the semester, but must take special examinations later; and in laboratory courses such students will be registered as incomplete at the close of the semester.

**Grades**—The grades given are A, excellent; B, good; C, medium; C—, barely passing; D, a failure that may be removed by extra-class requirement, or examination only at the time set for condition examinations; X, a failure that can be removed only by repeating the course; I, incomplete, because of illness or other accepted reasons. Incomplete work may be made up at the pleasure of the instructor.

Eighty percent of the work done for a degree must be above the grade C—.

Only one attempt to remove a D condition by examination or extra-class work is permitted. Such a condition must be removed before the course in which it has been obtained has been repeated, and if not so made up, automatically becomes X, necessitating the repetition of the course.

**Entrance Conditions**—All entrance conditions must be removed not later than the beginning of the Junior year.

**Eligibility to Student Activities**—A student must be carrying at least ten units of work satisfactorily to be eligible for any regular student activities.

**Classification**—A student to have Sophomore standing must have obtained 20 units of college credit, and must have fulfilled the entrance requirements.

A student to have Junior standing must have obtained 55 units of college credit, and must have fulfilled the entrance requirements.

Classification is based upon the number of units credited at the beginning of the school year.

**Petitions**—Students or classes desiring to make requests of the faculty should file their petition in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.



# DEGREES

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## THE BACHELOR'S DEGREE

**General Statement**—The University offers four-year courses of literary and scientific study leading to the degrees of Bachelor of Arts and Bachelor of Science, and four-year courses of more technical study leading to the degrees of Bachelor of Law and Bachelor of Science in some specified field: Agriculture, Commerce, Chemistry, Civil, Electrical, or Mechanical Engineering, or Mining Engineering and Metallurgy. Great latitude of election is given in literary and scientific courses, but the technical courses are more rigid in their requirements.

**The Unit System**—Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units or credits. A unit usually represents one hour of class-room work a week for a semester, and assumes three hours of application; it may stand for one hour of class-room work and two hours of preparation, or for three hours of laboratory work, or for such distribution as the particular course may demand.

**Number of Units Required for Degrees**—The number of units required for graduation varies with the course chosen:

In the courses leading to the degrees, Bachelor of Arts, Bachelor of Science, Bachelor of Laws, Bachelor of Science in Agriculture, and Bachelor of Science in Commerce, 124 units, including four units in Military Tactics for men and four units in Physical Training for women, will be required of students entering after the year 1914-1915.

In courses leading to the degrees, Bachelor of Science in Chemistry, Bachelor of Science in Civil Engineering, Bachelor of Science in Electrical Engineering, Bachelor of Science in Mechanical Engineering, Bachelor of Science in Mining Engineering and Metallurgy, the requirement for graduation will be 144 units, including four units in Military Tactics for men and four units of Physical Training for women, for students entering later than 1914-15.

**Reduction of Number of Units**—The reduction of the number of units in the courses now calling for 124 units for graduation, does not mean a lowering of the standard for a degree, but is rather the result of an increase in the value of the unit that will go into effect at once. In order to change without a decided break from a requirement of 132 to 124 units, those graduating in 1916 will be required

to complete 129 units of work, those graduating in 1917 will be required to complete 127 units of work, and those graduating in 1918 and thereafter will be required to complete 124 units.

**Thesis**—Any candidate for a degree may present as part fulfillment of requirements for graduation an acceptable Thesis embodying the result of a special study of some subject within the range of the course pursued. The subject and the credit value of the Thesis are to be submitted for the approval of the faculty at the opening of the Senior year, and the completed Thesis must be presented not later than three weeks before Commencement Day.

**Grouping of Subjects**—For convenience in outlining courses the various subjects taught in the University are grouped as follows:

GROUP I. English Composition and Rhetoric, English Literature.

GROUP II. Latin, Greek.

GROUP III. Spanish, French, German.

GROUP IV. History and Archaeology, Social Science, Philosophy and Psychology, Education, Law, History of Art, History of Music.

GROUP V. Military Tactics, Physical Training.

GROUP VI. Astronomy, Botany, Chemistry, Geology, Mathematics, Mineralogy, Physics, Zoology, Bacteriology.

GROUP VII. Agriculture, Home Economics, Mechanic Arts, Military Science, Engineering, Metallurgy.



### SUGGESTED COURSES FOR DEGREE OF BACHELOR OF SCIENCE WITH MAJOR IN HOME ECONOMICS

Candidates for the degree of Bachelor of Science who wish to make Home Economics a major subject are advised to elect their work in accordance with one or the other of the courses outlined below:

### COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE WITH MAJOR IN FOODS AND COOKERY

#### FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Mathematics 9.....	4	Mathematics 10.....	4
Chemistry 1.....	4	Chemistry 2.....	4
Modern Language.....	4	Modern Language.....	4
Physical Training.....	1	Physical Training.....	1
	<hr/> 16		<hr/> 16

#### SECOND YEAR

English 3.....	2	English 4.....	2
Modern Language.....	4	Modern Language.....	4
Chemistry 23.....	4	Chemistry 3.....	4
H. E. 1 (Elementary Food Preparation).....	3	H. E. 2 (Elementary Food Preparation).....	3
Physical Training.....	1	Physical Training.....	1
*Elective.....	2	Elective.....	2
	<hr/> 16		<hr/> 16

#### THIRD YEAR

Zoology 4 (Physiology).....	4	Zoology 5 (Physiology).....	4
Bacteriology.....	1	Drawing.....	2
Drawing.....	2	History of Education.....	4
History of Education.....	4	H. E. 4 (Food Economics).....	3
H. E. 3 (Food Economics).....	3	Chemistry of Foods.....	2
Elective.....	2		
	<hr/> 16		<hr/> 15

#### FOURTH YEAR

H. E. 11 (Theory and practice of Teaching Foods and Cookery).....	2	H. E. 12 (Theory and Practice of Teaching Foods and Cookery).....	2
H. E. 9 (House Planning, Furnishing and Decoration).....	2	H. E. 10 (House Planning, Furnishing and Decoration).....	2
H. E. 7 (Dietetics).....	3	H. E. 8 (Dietetics).....	3
Electives.....	8	Electives.....	7
	<hr/> 15		<hr/> 14

Total, 124 units.

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\*H. E. 5 and 6 (Demonstration Cookery, Home Cookery and Table Service), H. E. 13 and 14 (Elementary Clothing and Hand Work), H. E. 17 (Drafting, Draping, and Pattern Making), H. E. 22 and 23 (Millinery), Landscape Gardening, History of Art, and Psychology, are recommended electives.

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE WITH MAJOR IN TEXTILES AND CLOTHING

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
H. E. 13 (Elementary Clothing).....	3	H. E. 14 (Elementary Clothing).....	3
Drawing .....	2	Drawing .....	2
Mathematics 9.....	4	Mathematics 10.....	4
Modern Language.....	4	Modern Language.....	4
Physical Training.....	1	Physical Training.....	1
	<hr/> 17		<hr/> 17

## SECOND YEAR

English 3.....	2	English 4.....	2
Modern Language.....	4	Modern Language.....	4
*Science Group VI.....	4	*Science Group VI.....	4
H. E. 15 (History of Costume and Costume Design).....	3	H. E. 16 (History of Costume and Costume Design).....	3
Physical Training.....	1	H. E. 17 (Drafting, Draping, and Pattern Making).....	2
Bacteriology .....	1	Physical Training 1.....	1
	<hr/> 15		<hr/> 16

## THIRD YEAR

H. E. 18 (Dressmaking).....	2	H. E. 19 (Dressmaking).....	2
H. E. 22 (Millinery).....	2	H. E. 23 (Millinery).....	2
Zoology 4 (Physiology).....	4	Zoology 5 (Physiology).....	4
Education 1.....	4	Education 2.....	4
†Electives .....	3	H. E. 24 (Textiles).....	3
	<hr/> 15		<hr/> 15

## FOURTH YEAR

H. E. 20 (Advanced Dressmak- ing) .....	2	H. E. 9 (House Furnishing, Planning and Decoration).....	2
H. E. 19 (House Furnishing, Planning and Decoration).....	2	H. E. 26 (Theory and Practice of Teaching Textiles and Clothing) .....	2
H. E. 25 (Theory and Practice of Teaching Textiles and Clothing) .....	2	Electives .....	10
Electives .....	9		
	<hr/> 15		<hr/> 14

Total, 124 units.

\*Chemistry, Botany, Physics, or Astronomy suggested. See requirements for B. S. degree.

†H. E. 21 (Advanced Dressmaking), H. E. 1 and 2 (Elementary Food Preparation), History of Art, Landscape Gardening, Social Science 2, and Psychology are recommended electives.



## REQUIREMENTS FOR DEGREE OF BACHELOR OF LAWS

Group I.....	10 units, including 1, 2, 3, 4.
Group II, III.....	8 units, one subject.
Group IV.....	8 units, subject other than Law.
Group V.....	4 units, one subject.
	30 units, Group I, II or III, IV, V.
	72 units, Department of Law.
	22 units, Free Electives.

Total, 124 units.

COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
IN AGRICULTURE

Subjects required of all students in this course, with assigned units.

English 1, 2.....	6	Agriculture 2 or 26.....	3
Mathematics 1a, 1b or 9, 10.....	6	Agriculture 3.....	3
Military Tactics.....	4	Agriculture 6 or 17.....	3
Mechanic Arts 1.....	2	Agriculture 9.....	4
Chemistry 1, 2.....	8	Agriculture 10.....	4
Physics 1, 2.....	8	Agriculture 18.....	4
Botany 1, 3.....	8	Agriculture 24.....	3
Social Science 1, 2.....	6		
Modern Language .....	16		24
	64	Agricultural Group Electives (not less than 16 units in one group) .....	30
		Free Electives.....	6

Total, 124 units.

## AGRICULTURAL GROUP ELECTIVES

- Group I. Agronomy. Agriculture 1, 5, 7, 23; Chemistry 3, 23.
- Group II. Horticulture. Agriculture 1, 5, 13a, 13b, 14, 19, 20; Botany 11, 14.
- Group III. Animal Husbandry. Agriculture 4, 11, 12, 15, 16, 21, 22, 25; Botany 10.
- Group IV. Agricultural Chemistry. Chemistry 3, 23, 7, 8, 9, 10; Food Chemistry.
- Group V. Biology. Botany 2, 3, 5, 10, 11, 12, 13; Bacteriology; (Entomology); Zoology 1, 2, 3, 4, 5.
- Group VI. Rural Engineering. Students electing a major in this group should take Mathematics 2, 3, 4, 5, as electives; Mechanic Arts 8, 9, 11; Mechanical Engineering 1, 2, 3, 4, 12, 14; Civil Engineering 1, 2, 6, 11, 13, 14a, 14b, 15, 19, 20, 22; Electrical Engineering 1, 9.
- Group VII. Rural Economics and Administration. Bibliography 1, 2; Civil Engineering 15; Social Science 4a, 9, 12, 13, 18; English 3, 4, 20, 21; Law 3 or 6 units.

The following 4-year schedule is offered for the guidance of the student, and is advisory only. It may be varied to meet the individual needs, but elementary sciences should be taken early and attention given to prerequisites for the advanced courses.

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 or Mod. Lang.....	3 or 4	English 2 or Mod. Lang.....	3 or 4
Botany 1 or Chemistry 1.....	4	Botany 3 or Chemistry 2.....	4
Mechanic Arts 1.....	2	Agr. Group Elective (Mech.	
Mathematics 1a, 1b or 9.....	3 or 4	Arts 8, Bot. 4).....	4 to 7
Agr. 3, 26 or Agr. Group		Agr. 2.....	3
Elective .....	3 or 4	Mathematics 10.....	4
Military Tactics 1.....	1	Military Tactics 2.....	1
	16		16

## SECOND YEAR

English 2 or Mod. Lang. or		English 2 or Mod. Lang. or	
Free Elective.....	3 to 7	Free Elective.....	3 to 7
Botany 1 or Chemistry 1.....	4	Botany 3 or Chemistry 2.....	4
Agr. 9 or Agr. Group Elec-		Agr. 10 or 18.....	4
tive (Mech. Arts 9).....	4 to 7	Agr. Group Elective (Mech.	
Military Tactics 3.....	1	Eng. 14, Bot. 4).....	3 to 6
	16	Military Tactics 4.....	1
			16

## THIRD YEAR

Mod. Lang. or Free Elective.....	4	Mod. Lang. or Free Elective.....	4
Physics 1.....	4	Physics 2.....	4
Agr. 9, 17, or Agr. Group Elec-		Agr. 6, 10, 18, or Agr. Group	
tives (C. E. 1 or 19).....	8	Electives (C. E. 20).....	8
	16		16

## FOURTH YEAR

Mod. Lang. or Free Elective.....	4	Mod. Lang. or Free Elective.....	4
Social Science 1.....	3	Social Science 2.....	3
Agr. 9, 17, 24, or Agr. Group		Agr. 6, 10, 18, or Agr. Group	
Electives .....	9	Electives .....	9
	16		16

Total, 124 units.

## TWO-YEAR SHORT COURSE IN AGRICULTURE

(Not Leading to a Degree)

Any student who shall have obtained 60 units of University credit of which 4 shall be in Military Tactics and not less than 40 units shall be in Agricultural Science and must include Botany 1, 3, and Agriculture 2 or 26, 3, 9, shall be eligible to a certificate for having completed the short course in Agriculture. Any person holding a short course certificate who shall have met the entrance requirements for the four-year course in Agriculture, shall have Junior rank.

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Mathematics 1.....	5	Mathematics 2.....	4
German 1 or French 1.....	4	German 2 or French 2.....	4
Chemistry 1.....	4	Chemistry 2.....	4
Military Tactics 1.....	1	Military Tactics 2.....	1
Mech. Arts 1.....	2	Mech. Arts 2.....	3
	<hr/>		<hr/>
	19		19

## SECOND YEAR

English 3.....	2	English 4.....	2
Mathematics 3.....	4	Mathematics 4.....	4
German 3 or French 3.....	4	German 4 or French 4.....	4
Physics 1.....	4	Physics 2.....	4
Chemistry 23.....	4	Chemistry 3.....	4
Military Tactics 3.....	1	Military Tactics 4.....	1
	<hr/>		<hr/>
	19		19

## THIRD YEAR

Chemistry 4.....	2	Chemistry 24, 25.....	4
Chemistry 7.....	4	Chemistry 8.....	4
Geology 13.....	2	Geology 14.....	2
Mineralogy 1, 3.....	3	Chemistry 9.....	2
Metallurgy 2.....	2	Electives .....	5
Electives .....	4		
	<hr/>		<hr/>
	17		17

## FOURTH YEAR

Metallurgy 10.....	3	Metallurgy 11.....	2
Chemistry 14.....	2	Chemistry 15.....	2
Thesis .....	2	Chemistry 10.....	2
Electives .....	10	Thesis .....	2
		Electives .....	9
	<hr/>		<hr/>
	17		17

Total, 144 units.

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Language .....	4	Language .....	4
Mathematics 1.....	5	Mathematics 2.....	4
Chemistry 1.....	4	Chemistry 2.....	4
Mech. Arts 1.....	2	Mech. Arts 2.....	3
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

Mathematics 3.....	4	Mathematics 4.....	4
Physics 1.....	4	Physics 2.....	4
Mech. Arts 3.....	3	Mech. Arts 4.....	3
English 3.....	2	English 4.....	2
Civil Eng. 1.....	3	Civil Eng. 2.....	3
Military Tactics 3.....	1	Military Tactics 4.....	1
Elective .....	2	Elective .....	2
	<hr/> 19		<hr/> 19

## THIRD YEAR

Mathematics 5.....	4	Mathematics 6.....	4
Civil Eng. 11.....	4	Civil Eng. 14a and b.....	4
Civil Eng. 9.....	2	Civil Eng. 10.....	2
Option 1:		Option 1:	
Geology 13.....	2	Geology 14.....	2
Electives .....	5	Electives .....	5
Option 2:		Option 2:	
Astronomy 3.....	3	Physics 4.....	3
Electives .....	4	Electives .....	4
	<hr/> 17		<hr/> 17

## FOURTH YEAR

Mech. Eng. 4 or Elec. Eng. 9....	3	Mech. Eng. 3.....	3
Civil Eng. 7.....	4	Civil Eng. 8.....	4
Civil Eng. 13.....	3	Civil Eng. 6.....	4
Civil Eng. 17.....	2	Civil Eng. 18.....	3
Bacteriology .....	1	Elective .....	3
Civil Eng. 15.....	2		
Elective .....	2		
	<hr/> 17		<hr/> 17

Total, 144 units.

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition).....	3	English 2 (Composition).....	3
Math. 1 (Algebra and Trig.).....	5	Math. 2 (Analytical Geom.).....	4
Foreign Language.....	4	Foreign Language.....	4
Mech. Arts 1 (Eng. Draw.).....	2	Mech. Arts 2 (Descript. Geom.)	3
Chemistry 1.....	4	Chemistry 2.....	4
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

Math. 3 (Diff. Cal.).....	4	Math. 4 (Int. Cal.).....	4
Physics 1 (General).....	4	Physics 2 (General).....	4
English 3 (Literature).....	2	English 4 (Literature).....	2
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
Mech. Eng. 1 (Mechanisms).....	2	Mech. Eng. 2 (Mach. Draw.).....	3
C. E. 19 (Surveying).....	2	C. E. 20a (Surveying).....	2
Military Tactics 3.....	1	Military Tactics 4.....	1
	<hr/> 19		<hr/> 19

## THIRD YEAR

Math. 5 (Theor. Mech.).....	4	Math. 6 (Theor. Mech.).....	4
Mech. Arts 5 (Mach. Shop).....	2	Mech. Eng. 3 (Heat Engines)....	3
Mech. Eng. 5 (Mach. Design.)....	3	Mech. 15 (Elec. Mach. Design.)	2
Elec. Eng. 9 (General).....	3	Elec. Eng. 1 (Direct Current)....	3
Civ. Eng. 11 (Hydraulics).....	4	Civ. Eng. 14 (Mech. of Ma- terials) .....	4
Elective .....	2	Seminar .....	1
	<hr/> 18	Elective .....	<hr/> 1
			18

## FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.).....	2	Mech. Eng. 8 (Mech. Lab.).....	2
Elec. Eng. 7 (Design.).....	3	Elec. Eng. 8 (Elec. Sta. Design.)	3
Elec. Eng. 5 (Lab.).....	2	Elec. Eng. 6 (Lab.).....	2
Elec. Eng. 2 (Alt. Current).....	4	Elec. Eng. 3 (Illumination).....	2
Seminar .....	1	Elec. Eng. 4 (Elec. Traction)....	2
Elective .....	4	Mech. Eng. 12 (Power Plants)	2
	<hr/> 16	Elective .....	<hr/> 3
			16

Total, 144 units.



# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition).....	3	English 2 (Composition).....	3
Math. 1 (Algebra and Trig.)....	5	Math. 2 (Analytical Geom.)....	4
Foreign Language.....	4	Foreign Language.....	4
Mech. Arts 1 (Eng. Draw.).....	2	Mech. Arts (Descript. Geom.)....	3
Chemistry 1 (General).....	4	Chemistry 2 (General).....	4
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

Math. 3 (Diff. Cal.).....	4	Math. 4 (Integral Cal.).....	4
Physics 1 (General).....	4	Physics 2 (General).....	4
English 3 (Literature).....	2	English 4 (Literature).....	2
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
Mech. Eng. 1 (Mechanisms).....	3	Mech. Eng. 2 (Mach. Draw.).....	3
Civ. Eng. 19 (Surveying).....	2	Civ. Eng. 20a (Surveying).....	2
Military Tactics 3.....	1	Military Tactics 4.....	1
	<hr/> 19		<hr/> 19

## THIRD YEAR

Math. 5 (Theor. Mech.).....	4	Math. 6 (Theor. Mech.).....	4
Mech. Arts 5 (Mach. Shop).....	2	Mech. Arts 6 (Mach. Shop).....	2
Mech. Eng. 5 (Mach. Design.)....	3	Mech. Eng. 6 (Mach. Design.)....	3
Elec. Eng. 9 (General).....	3	Mech. Eng. 3 (Heat Engines)....	3
Civ. Eng. 11 (Hydraulics).....	4	Civ. Eng. 14 (Mech. of Ma- terials) .....	4
Elective .....	2	Mech. Eng. 16 (Seminar).....	1
	<hr/> 18	Elective .....	<hr/> 1
			18

## FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.).....	3	Mech. Eng. 8 (Mech. Lab.).....	3
Mech. Eng. 9 (Eng. Design.)....	2	Mech. Eng. 10 (Engine Design.)	2
Mech. Eng. 11 (Adv. Heat En- gines) .....	2	Mech. Eng. 12 (Power Plants)....	2
Civ. Eng. 7 (Steel Mill Bldgs.)	4	Thesis (or Elective).....	4
Mech. Eng. 13 (Seminar).....	1	Electives .....	5
Elective .....	4		
	<hr/> 16		<hr/> 16

Total, 144 units.

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN MINING ENGINEERING AND METALLURGY

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Math. 1 (Alg. and Trig.).....	5	Math. 2 (Analytics).....	4
Mech. Arts 1 (Mech. Draw.).....	2	Mech. Arts 2 (Descript. Geom.).....	3
Chem. 1 (General Chem.).....	4	Chem. 2 (General Chem.).....	4
Modern Language.....	4	Modern Language.....	4
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

English 3 (Literature).....	2	English 4 (Literature).....	2
Chem. 23 (Qual. Anal.).....	4	Chem. 3 (Quan. Anal.).....	4
Math. 3 (Diff. Cal.).....	4	Math. 4 (Int. Cal.).....	4
Civ. Eng. 1 (Surveying).....	3	Civ. Eng. 2 (Mine Surveying).....	3
Physics 1.....	4	Physics 2.....	4
Mech. Eng. 1 (Mechanisms).....	1	Military Tactics 4.....	1
Military Tactics 3.....	1		
	<hr/> 19		<hr/> 18

## THIRD YEAR

Math. 5 (Anal. Mech.).....	4	Math. 6 (Theor. Mech.).....	4
Geol. 1 (Gen. Geol.).....	3	Geol. 2 (Struct. and Lith.).....	3
Chem. 4 (Volumetric).....	2	Chem. 24 (Met. Analysis).....	2
Mineralogy 1 and 3 (Blowpipe).....	3	Mineralogy 4 (Descriptive).....	3
Met. 2 (Assaying).....	2	Civ. Eng. 14 (Strength of Ma-	
Mining 10 (Excavations).....	3	terials).....	4
		Elective .....	2
	<hr/> 17		<hr/> 18

## FOURTH YEAR

Six weeks underground mining, no credit.

	FIRST SEMESTER			SECOND SEMESTER		
	OPTIONS			OPTIONS		
	Geol.	Min.	Met.	Geol.	Min.	Met.
Geol. 3 and 4 (Econ. Geol.).....	3	3	3	3	x	x
Met. 11 and 12 (Gen.).....	3	3	6	2	2	2
Min. 11 and 12 (Ore Dress.).....	3	3	3	x	3	3
E. E. 9 (Elec. Mach.).....	2	2	2	x	x	x
Min. 13 (Machinery).....	x	2	2	x	x	x
Min. 14 (Methods).....	x	x	x	2	5	2
Geol. 5 and 6 (Field Geol.).....	3	3	x	3	x	x
Mineralogy 5 and 6 (Opt. and Petrog.).....	2	x	x	2	x	x
M. E. 3 (Heat Engines).....	x	x	x	x	x	3
C. E. 11 (Hydraulics).....	x	x	x	2	2	2
Met. 14 (Cyaniding).....	x	x	x	x	4	4
Geol. 8 (North America).....	x	x	x	2	x	x
Elective .....	1	1	1	1	1	1

Total, 144 units.

17

17

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN COMMERCE

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Foreign Language.....	4	Foreign Language.....	4
History 1.....	3	History 2.....	3
Social Science 1.....	3	Social Science 2.....	3
Accounting .....	2	Accounting 2.....	2
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 16		<hr/> 16

## SECOND YEAR

Foreign Language.....	4	Foreign Language.....	4
Social Science 3.....	4	Social Science 4.....	4
Social Science 5.....	3	Social Science 5a.....	3
Science or Mathematics.....	4	Science or Mathematics.....	4
Military Tactics 3.....	1	Military Tactics 4.....	1
	<hr/> 16		<hr/> 16

## THIRD YEAR

Law or Social Science 7.....	3	Law or Social Science 8.....	3
English .....	2	English .....	2
History .....	3	History .....	3
Social Science 18.....	3	Social Science.....	3
Elective .....	5	Elective .....	5
	<hr/> 16		<hr/> 16

## FOURTH YEAR

Social Science 9.....	3	Social Science 10.....	3
Social Science 15 or 16.....	3	Social Science 12b.....	3
Social Science 12a.....	3	Law or Psychology.....	3
Law or Psychology.....	3	Elective .....	5
Elective .....	2		
	<hr/> 14		<hr/> 14

Total, 124 units.

## THE TWO-YEAR COURSE IN COMMERCE

(Not Leading to a Degree)

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1.....	3	English 2.....	3
Elementary Accounting.....	2	Elementary Accounting.....	2
Social Science 1.....	3	Social Science 2.....	3
Social Science 3.....	4	Social Science 3.....	4
History 1.....	3	History 2.....	3
Military Tactics 1.....	1	Military Tactics 2.....	1
	<hr/> 16		<hr/> 16

## SECOND YEAR

Spanish .....	4	Spanish .....	4
Commercial Law.....	3	Commercial Law.....	3
Social Science 5.....	4	Social Science 5a.....	3
Social Science .....	3	Social Science .....	3
Business Practice.....	3	Business Practice.....	3
Military Tactics 3.....	1	Military Tactics 4.....	1
	<hr/> 17		<hr/> 17

## ADVANCED DEGREES

Advanced degrees will be given only for work done in residence, to candidates who have received the Bachelor's degree from this institution or one of similar standing. Thirty units of such work, together with a Thesis, will be required for the degree of Master of Arts or Master of Science. The course in each case will be laid out by those in charge of the departments in which the work for the degree is to be taken, and must be approved by a committee composed of all the heads of departments.

Mining Engineering—Students who expect to make Mining Engineering their profession are advised to take a fifth year, or a five-year course, since the four-year course gives insufficient time for a student to master all the subjects that are essential for the practice of Mining Engineering.

## REQUIREMENTS FOR THE DEGREE OF ENGINEER OF MINES

Undergraduate Work—Candidates must complete the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, as given by the University of Arizona, or the equivalent of this course in some school of recognized standing.

Graduate Work—The fifth year's course will consist of not less than 30 units of resident work, to include (1) all of the following

courses, the equivalent of which has not been taken by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy 1, 2, 3, 4; Mining Engineering 1, 2, 3, 4, 5, 6, 7, 8; Metallurgy 1, 2, 3, 4, 5, 7. (2) At least 8 units of graduate work in Mineralogy, Geology, Mining Engineering or Metallurgy. (3) The remainder of the 30 units may be chosen from any of the Departments of Engineering, but should not be of lower grade than Junior work. Six months of work underground and in smelters, with a satisfactory detailed report on the same will be required.

Graduate Assistants in the State Bureau of Mines—The University of Arizona has established in connection with the State Bureau of Mines a limited number of positions employing graduate assistants, paying approximately \$400 per academic year.

The Arizona State Bureau of Mines is devoted entirely to research, its purpose being the study of problems of especial interest to engineers and to the mining and metallurgical industries of Arizona.

The graduate assistants appointed, agree to hold these positions during the academic year, devoting one-half of their time to research work in connection with the Bureau of Mines which is applicable for Thesis credit not to exceed ten units; the remaining time is devoted to graduate study in candidacy for a degree.

Applications for such positions should be made to the University of Arizona, Tucson.



## DESCRIPTION OF COURSES OF INSTRUCTION

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The number by which a course is designated is not intended to indicate the relative advancement of the course.

The faculty reserves the right to cancel any class when a suitable number of students fails to register for it.

A student must meet the prerequisites or otherwise satisfy the instructor in charge, of his ability to take a course for which he has registered.

For the hours of classes, the student is referred to the horarium issued at the opening of the college year.

### AGRICULTURE

#### AGRONOMY

PROFESSORS FORBES, MORSE, VINSON, MR. CATLIN, AND MR. UPHOF

#### 2. Farm Crops.

PROFESSOR MORSE

A brief study of cereals and various other farm crops of the United States; a more detailed study of those that may be grown successfully in Arizona; commercial varieties, methods of culture, and market demands. Required, optionally with course 26, of all students in agriculture. Three hours. Second semester. Three units.

#### 6. Plant Breeding.

MR. UPHOF

The general principles of plant breeding; detailed study of the methods pursued and results obtained by leading plant breeders in various Experiment Stations and in private work. Required, optionally with course 17, of all students in agriculture. Prerequisite, Botany 1. Three hours. Second semester. Three units.

#### 7. Dry Farming.

PROFESSOR FORBES

Rainfall and other climatic conditions in the various dry farming regions of the world; general dry farming methods; crops adapted to dry farming; dry farming methods and possibilities in Arizona. Review of bulletins dealing with experimental work; lectures and library work. Prerequisites, Agriculture 2 and 9. Three hours. First semester. Three units.

## 9. Soil Physics.

PROFESSOR VINSON AND MR. CATLIN

Origin, composition, and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture, and plant food; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in agriculture. Three lectures and one three-hour laboratory period. First semester. Four units.

## 10. Soil Fertility.

PROFESSOR VINSON AND MR. CATLIN

Amount and availability of the various elements of plant food in soils; relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; making and using farm manures; crop rotations; the Rothamstead experiments; theory of toxic substances in soils. Required of all students in agriculture. Lectures and laboratory work. Prerequisites, Chemistry 1, 2, and Agriculture 9. Three lectures and one three-hour laboratory period. Second semester. Four units.

## 23. Agronomy Literature.

Daily and weekly reports upon assigned readings in bulletins and standard works, to round out the student's knowledge of the general field of agronomy, and to prepare the way for research in the subject. Open to Juniors and Seniors.

## 24. Farm Management.

PROFESSOR MORSE

Purchase, organization, equipment, and management of farms with reference to financial returns; farm accounts, market demands, marketing associations; the farm lay-out, farm buildings, leveling for irrigation, location and management of ditches, are among the subjects to be discussed. Required of all students in agriculture. Two lectures and one three-hour laboratory period. First semester. Three units.

**ANIMAL HUSBANDRY**

PROFESSOR WILLIAMS AND MR. CUNNINGHAM

## 3. Live Stock Judging.

MR. CUNNINGHAM

Judging different classes of horses, cattle, sheep, and swine. Use of the score card; practice in comparative judging. Animals from the University herd are used, supplemented by live stock belonging to neighboring ranchmen and farmers. Required of all students in

agriculture. Text: Craig's *Judging of Live Stock*. Reference: Gay's *Principles and Practice of Judging Live Stock*. Two lectures and one three-hour demonstration. First semester. Three units.

4. Elements of Dairying.

MR. CUNNINGHAM

A study of profitable dairying, herd improvement and dairy sanitation. Secretion, composition and properties of milk; methods of cream separation, including a study of the construction and operation of centrifugal separators; testing milk and other products; care of milk and cream on the farm and the manufacturing and marketing of butter. Two lectures, one three-hour laboratory period. Second semester. Three units.

11. History of Breeds.

MR. CUNNINGHAM

Characteristics of each breed of horses, cattle, sheep, swine, and goats; origin, history, and development; introduction to America, and adaptability to Arizona conditions. Text: Plumb's *Types and Breeds of Farm Animals*. Three hours. Second semester. Three units.

12. Poultry Husbandry.

PROFESSOR WILLIAMS

General care and management of poultry, including the production of eggs and poultry for market; breeds; breeding; judging; feeds and feeding; diseases and pests; marketing; incubation and brooding. Recitations, lectures, laboratory work, and visits to poultry ranches. Two lectures, one three-hour laboratory period. First semester. Three units.

15. Veterinary Physiology.

MR. CUNNINGHAM

Special physiology of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory. Three hours. First semester. Three units.

16. Animal Diseases.

MR. CUNNINGHAM

(a) General and specific causes of diseases and methods of prevention; errors in feeding and in care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations; (b) diagnosis and treatment of common ailments of farm animals; (c) simple operations. Text-book: Mayo's *The Diseases of Animals*. Lectures, recitations, and clinics. Three hours. Second semester. Three units.

## 17. Animal Breeding.

MR. CUNNINGHAM

Principles of breeding, including the study of variation and its causes; the influence of environment on the development of animals; heredity, atavism, reversion, and selection. Special attention is given to the methods of breeding used by the most successful stockmen in the improvement of breeds. Required, optionally with course 6, of all students in agriculture. Prerequisites: Botany 1 or Zoology 1, Agriculture 3 or 11. Three hours. First semester. Three units.

## 18. Feeds and Feeding.

MR. CUNNINGHAM

Principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical feeding of animals for various purposes. Prerequisite: Chemistry 1, 2. Required of all students in agriculture. Four hours. Second semester. Four units.

## 21. Advanced Live Stock Judging.

PROFESSOR WILLIAMS

A detailed study of the various types, classes and breeds of live stock; special practice given in the judging of groups, making comparisons and giving reasons. Trips are made to large herds, and students are required to attend the State Fair at Phoenix. Prerequisites: Agriculture 3 and 11. One lecture, two three-hour demonstrations. First semester. Three units.

## 22. Animal Husbandry Literature.

PROFESSOR WILLIAMS

Survey of the literature relating to animal husbandry; selecting and compiling data; assigned readings and reports on special subjects. Open to Juniors and Seniors. Three hours. Second semester. Three units.

## 25. Meat Production.

PROFESSOR WILLIAMS

The study of meats and meat products with special emphasis on the selection and preparation of animals for the feed yard, show ring, market, butcher, and consumer. Prerequisite, Agriculture 3. Two lectures, one three-hour laboratory period. Second semester. Three units.

**HORTICULTURE**

PROFESSOR LAWRENCE AND MR. JOHNSON

## 1. Principles of Plant Propagation.

MR. JOHNSON

A thorough and practical training in the propagation of plants, including a study of soils used in the nursery and seed bed; seed testing; seeding and transplanting; and multiplying of plants by separation

and division, cuttings, layerings, budding and grafting. Reference reading and the preparation of reports. One lecture and two three-hour laboratory periods. Second semester. Three units.

26. Horticultural Crops.

MR. JOHNSON

A study of vegetables and fruits with special reference to their adaptability and uses throughout Arizona. A general view of the principles and practices in horticulture, fitting the student for diversified farm work or for general science teaching. Required, optionally with Agriculture 2, of all students in agriculture. Three hours. First semester. Three units.

5. Vegetable Gardening.

MR. JOHNSON

Practical and theoretical training in the general principles underlying successful intensive farming; detailed study of the various crops grown for the home and for market, with special reference to Arizona conditions. Lectures, laboratory, and practice on the farm. Three hours. First semester. Three units.

13a. Pomology.

PROFESSOR LAWRENCE

Orchard management, and detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties. Three hours. First semester. Three units.

13b. Pomology Laboratory.

MR. JOHNSON

Describing and judging varieties; pruning; preparation of spray materials; study of spraying apparatus and orchard implements. To be taken in connection with Agriculture 13a, Pomology, or Agriculture 19, Small Fruits. One three-hour laboratory period. One unit.

14. Citrus Fruits.

PROFESSOR LAWRENCE

Culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Three lectures, one three-hour laboratory period. Second semester. Four units.

19. Small Fruits.

MR. JOHNSON

Small fruits such as the strawberry, the grape, and the various bush fruits. To be accompanied by Agriculture 13b, Pomology Laboratory. Two hours. First semester. Two units.



## 20. Horticultural Literature.

Assigned readings in bulletins and standard works upon horticulture; daily and weekly reports presenting a comprehensive view of the general field of horticulture and laying the foundation for research work. Open to Juniors and Seniors. Three hours. Second semester. Three units.

### SHORT COURSE IN AGRICULTURE

This course is offered to meet the demands of prospective home-seekers in Arizona; to give the student unable to pursue a full college course a brief introduction to successful farming, and to give him a measure of that general culture incidental to university life, which makes for good citizenship. It equips young men to fill expert positions, which are now open in Arizona and which will become more frequent as the great reclamation projects are completed. The University from time to time has calls for farm managers at good salaries, and such calls will increase in number. Vast areas of desert land in Arizona may be reclaimed by pumping, the development of which has scarcely been touched; but to make the most of such opportunities one will need more mechanical skill and more knowledge of the physical properties of soil than the average farmer possesses. Courses in Irrigation, Engineering, Farm Management, Soil Physics, Vegetable Gardening, Orchard Management, and Farm Dairying equip young men to take advantage of these opportunities and positions.

Students will be admitted to the Short Course who have a general knowledge of the common school branches and sufficient maturity to understand the value of their time and opportunity. They enjoy the same privileges, and observe the same regulations as other students registered in the University.

The University is amply equipped with library, laboratory, and green-house facilities, and the theoretical knowledge gained therein and in class-work has an abundance of practical application on the University farm of 80 acres.

## ART

### ASSISTANT PROFESSOR NEWSOM

#### 1, 2. History of Painting.

A general survey of the history of painting, as follows: Early Christian and Byzantine, Italian, Spanish, Dutch and Flemish, French, German, English, American. Examination and comparison

of the methods of each school and period; a critical study of the great masters, their environment, their works, and their influence. Characteristic details of style are studied from photographs and plates. Lectures by the instructor; investigation and reports on assigned topics by students. Three hours. Both semesters. Three units, each semester.

### 3, 4. History of Italian Painting.

An intensive study: the early Christian and Byzantine sources; the Gothic Period; the early and the high Renaissance Periods; the Decadence; the influence on other schools of painting. Prerequisite: Art, 1, 2. Two hours. Both semesters. Two units, each semester.

## ASTRONOMY

PROFESSOR DOUGLASS

### 1, 2. Descriptive Astronomy.

The sun, moon, planets, and other celestial objects, with constant views of their telescopic appearance; discussion of the latest theories of the condition of the planets and the evolution of the universe. Non-mathematical; open to all students. Note books will be required. Two hours (with frequent substitution of an evening hour). Both semesters. Two units, each semester.

### 3. Engineering Astronomy.

Latitude, longitude, meridian, and time observations and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Astronomy 3 is required of Juniors in civil engineering. An elementary knowledge of spherical trigonometry is required for this course. Two hours, and one evening laboratory period of three hours. First semester. Three units.

### 4. Engineering Astronomy.

Continuation of Astronomy 3 with more exact measurements and use of the astronomical transit. One two-hour day period and one three-hour evening period. Second semester. Two units.

## BACTERIOLOGY

PROFESSOR MESERVE

The laboratory is well equipped with the necessary microscopes, hot air and Arnold sterilizers, autoclave and incubators. There is also a liberal supply of glassware and all the reagents, stains, and

apparatus employed in class and research work. The equipment will permit a broad scope of work in the field of bacteriology.

1. A brief laboratory course teaching the elements of microscopical and culture methods of examination, and removing the ordinary misconceptions concerning bacteria, rather than developing bacteriologists. Special attention to milk and water examination; the widespread influence of bacteria and yeasts on our daily life. Required of civil engineering and domestic arts students. Prerequisite: Chemistry 1, 2. Two two-hour periods a week during the first half of the first semester. One unit.

## BOTANY

PROFESSOR THORNBUR, MR. BROWN

### 1. Elementary Botany.

MR. BROWN

A general view of the great groups of plants; the morphology of types and their genetic relations; the gross and microscopic structure of plant organs, and the microscopic study of cell structure and phenomena including karyokinesis. Required of all agricultural students. Text: Bergen and Caldwell, *Practical Botany*. Two lectures and six laboratory hours. First semester. Four units. Laboratory fee \$2.

### 2. Plant Histology.

MR. BROWN

Microscopy, botanical microtechnique, use of the camera lucida, and the photographic camera. The greater part of the laboratory work is given to the use of chemical reagents and stains in the preparation of microscopic slides. For students who intend to teach botany or to take advanced work in this subject. Text: Chamberlain, *Methods in Plant Histology*. Prerequisite, Botany 1. Two lectures and six hours of laboratory work. Second semester. Four units. Laboratory fee \$2.

### 3. Plant Physiology.

MR. BROWN

Life processes of plants. Investigations of the properties of protoplasm; relations of plants to mechanical forces; influence of chemicals upon plants; relations of plants to water, gravitation, light, respiration, growth, and movement. Of interest to students of plant physiology, because of our interesting flora and climatic conditions. Required of students in horticulture and agronomy. Text: Barnes, *Text-book of Physiology*. Prerequisite, Botany 1. Two lectures and six hours of laboratory work. Second semester. Four units. Laboratory fee \$2.

## 4. Taxonomy.

PROFESSOR THORNER

Identification of plants. For those who expect to continue the study of botany, as well as for those who desire to know the common plants about them, both native and cultivated species. Particular attention to economic plants. Excursions to adjacent mountains, mesas and river valleys. Texts: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*; Gray, *Field, Forest and Garden Botany*; also other reference works. One lecture and six hours of laboratory work. Second semester. Three units. Laboratory fee \$2.

## 5. Taxonomy.

PROFESSOR THORNER

Continuation of course 4. Systematic study of our flora; citation of plant types and co-types; herbarium building; the art of keying plant groups. Study of a group. Different systems of classification are studied. Open to students who desire to continue the study of taxonomy. One lecture and six laboratory hours. First semester. Three units. Laboratory fee \$2.

## 6. General Morphology of Algae and Fungi.

MR. BROWN

The instructor must be consulted before registration. Prerequisites, Botany 1 and 2. Hours to be determined. Four units.

## 7. General Morphology of Bryophytes and Pteridophytes. Four units.

## 8. General Morphology of Spermatophytes. Four units.

## 9. History of Botany.

MR. BROWN

A lecture course dealing with (a) early descriptive botanists; (b) the period of artificial systems; (c) the beginning and development of modern botany; (d) botany and botanists of today. This course requires library work. Prerequisites, Botany 1, 2, 3, and 4. Two lectures. First semester. Two units.

## 10. Grazing Range Studies.

PROFESSOR THORNER

An economic study of the native grasses, saltbushes, cacti, and other forage plants, particularly as concerns their grazing value. Different types of ranges with the relation of rainfall to plant growth; the open range as contrasted with the advantages of fenced ranges. Poison plants and range weeds with means of eradication. Range restoration. Recommended for students in animal husbandry and general agriculture. Prerequisite, Botany 4. Two lectures and three hours of laboratory work. First semester. Three units.

## 11. Plant Pathology.

PROFESSOR THORNER

The principal groups of parasitic fungi and the plant diseases caused by them, together with methods of control. External factors causing pathological conditions in plants. The commoner plant diseases throughout the country. Prerequisites, Botany 1 and 3. One lecture and six hours laboratory work. First semester. Three units. Laboratory fee \$2.

## 12. Plant Pathology.

Continuation of course 11. Second semester. Three units. Laboratory fee \$2.

## 13. Geographical Botany.

MR. BROWN

Plant distribution over the earth's surface, with reasons for such distribution. General aspect of the vegetation characteristic of the hygrophytic forest, the tropophytic forest, the sclerophyll forest, the savannah, the steppe, the desert, the tundra. A considerable amount of reading in addition to class-room and field work is required. The lectures are frequently illustrated. Prerequisite, Botany 4. No laboratory work. Four lectures. First semester. Four units.

## 14. Landscape Gardening.

PROFESSOR THORNER

Native and introduced flowers, vines, shrubs, and trees adapted for growing under Southwestern conditions; lawn making, the rose garden, and hardy bulbous species. Different types of landscape gardening, aesthetic arrangement of trees and shrubs in country and urban homes to secure the best results in planting. Two lectures and three laboratory hours. Second semester. Three units.

## CHEMISTRY

PROFESSOR GUILD AND PROFESSOR BRINTON

## 1, 2. General Chemistry.

PROFESSORS GUILD AND BRINTON

Lectures and recitations illustrating the fundamental theories of chemistry together with a study of the chemical elements and their compounds. Text-book: Alex Smith, *General Chemistry for Colleges*. Three lectures and one three-hour laboratory period throughout the year. One extra conference period without credit for those entering without high school chemistry. Four units, each semester. Laboratory fee \$6, each semester.



## 23. Qualitative Analysis. PROFESSOR BRINTON

Text-book: A. A. Noyes, *Qualitative Analysis*. One lecture and nine hours laboratory work. First semester. Four units. Laboratory fee \$12.

## 3. Quantitative Analysis. PROFESSOR BRINTON

Text-book: Blasdale, *Principles of Quantitative Analysis*. Open to students who have taken Chemistry 23. One lecture and nine hours of laboratory work chiefly in gravimetric methods of analysis. Second semester. Four units. Laboratory fee \$12.

## 4. Volumetric Analysis. PROFESSOR BRINTON

A continuation of Chemistry 3, special attention being given to fundamental principles of volumetric analysis and thorough drill in the stoichiometric relation of standard solutions. Six hours laboratory work with occasional lectures. First semester. Two units. Laboratory fee \$6.

## 24-32. Special Quantitative Analysis. PROFESSOR BRINTON

Three hours laboratory work per unit.

24. Metallurgical Analysis. Two units. Laboratory fee \$6.

25. Fuel, Gas, and Oil Analysis. Two units. Laboratory fee \$6.

26. Electro-analysis. Two units. Laboratory fee \$6.

27. Water Analysis. Two units. Laboratory fee \$6.

28. Iron and Steel Analysis. Two units. Laboratory fee \$6.

29. Organic Elementary Analysis. Two units. Laboratory fee \$6.

30. Food Analysis. Three units. Laboratory fee \$9.

31. Soil and Fertilizer Analysis. Three units. Laboratory fee \$9.

32. Mineral Analysis. Two units. Laboratory fee \$6.

## 7, 8. Organic Chemistry. PROFESSOR GUILD

Two lectures and six hours laboratory work throughout the year. Prerequisite, Chemistry 2. Both semesters. Four units, each semester. Laboratory fee \$12, each semester.

## 9. Inorganic Preparations. PROFESSOR BRINTON

Preparation of pure chemical compounds from the crude materials. Prerequisite, Chemistry 4. Six hours laboratory work. Second semester. Two units. Laboratory fee \$6.

## 10. Physical Chemistry.

PROFESSOR GUILD

Lectures and laboratory work. Application of physico-chemical methods to the study of such problems as the determination of molecular weights, vapor densities, reaction velocity, conductivity, electro-motive force, etc. Prerequisite, Chemistry 3. Six hours laboratory work. Second semester. Two units. Laboratory fee \$6.

## 11, 12. Chemistry of the Rare Elements.

PROFESSOR BRINTON

Analysis and synthesis of uranium, molybdenum, tungsten, vanadium and cerium compounds. Prerequisite, Chemistry 9. One lecture and nine hours laboratory work. Both semesters. Four units, each semester. Laboratory fee \$6, each semester.

## 13. Special Chapters of Inorganic Chemistry.

PROFESSOR BRINTON

Lectures and laboratory practice on selected topics from the field of recent work in inorganic chemistry. Open to students who have taken Chemistry 3. Chemistry 9 is advised as preparation for this course. Second semester. Two units.

## 14, 15. Industrial Chemistry.

PROFESSOR BRINTON

Lectures and recitations on the application of chemistry to the process of modern industry and manufacture. Two hours. Both semesters. Two units, each semester.

## CIVIL ENGINEERING

PROFESSOR WATERBURY, ASSISTANT PROFESSOR KELTON, AND  
MR. MICOTTI

Some of the courses in civil engineering are offered on a consultation basis. For such courses the class does not meet in a body and periods will not be scheduled. Each student arranges with the instructor for the required consultation periods. In general, two or three consultation periods a week, in each subject, are required of each student. For courses requiring laboratory or drafting work the student must spend as much time in the laboratory or drafting room as may be required to complete the assigned work. A fee of \$1.00 is required for each course in this department.

## 1. Elementary Surveying.

ASSISTANT PROFESSOR KELTON AND MR. MICOTTI

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, and field work. Open to students who have taken trigonometry, and who have taken or are taking Mechanic Arts 1. Required of civil and mining engineering students. Two hours and Saturday morning. First semester. Three units.

## 2. Topographic and Mine Surveying.

ASSISTANT PROFESSOR KELTON AND MR. MICOTTI

A continuation of Civil Engineering 1. Topographic surveying and drawing, hydrographic surveying, patent surveys, and underground surveying. Open to students who have taken Civil Engineering 1. Required of civil and mining engineering students. Two hours and Saturday morning. Second semester. Three units.

## 3. Geodesy.

PROFESSOR WATERBURY

Precise triangulation work, including measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2, and Astronomy 3. This course may be given as a consultation course. One hour. First or second semester. One unit.

## 6. Concrete and Masonry Construction. PROFESSOR WATERBURY

Theory and practice in reinforced concrete construction. Foundations on land and in water, cofferdams, cribs, caissons, piers, and abutments, retaining walls, dams, and arches. Text-book: Baker, *Masonry Construction*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject. Two hours, and two three-hour drafting periods. Second semester. Four units.

## 7. Steel Mill Buildings.

PROFESSOR WATERBURY

Graphical and analytical computation of stresses in roof and bridge trusses; details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Text-book: Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject. Two hours and two three-hour drafting periods. First semester. Four units.

## 8. Bridge Design.

PROFESSOR WATERBURY

Computation of stresses due to moving loads upon various points of bridge structures; a detailed study of bridge designs and bridge erections; complete investigation with drawings, estimate of weights, and estimate of cost of a steel bridge. Text-book: Ketchum, *Design of Highway Bridges*. Open to students who have taken Civil Engineering 7. This course may be given as a consultation subject. Two hours and two three-hour drafting periods. Second semester. Four units.

## 9, 10. Railroad Engineering.

ASSISTANT PROFESSOR KELTON

Preliminary and location surveys; simple and easement curves, turnouts and switches; principles of economic location as based upon cost of construction, operating expenses, alignment, and grades; maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations and estimates of cost. Text-book: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2. One hour and one four-hour field or drafting period. Both semesters. Two units, each semester.

## 11. Hydraulics.

ASSISTANT PROFESSOR KELTON

Velocity and discharge from orifices, weirs, tubes, and pipes; flow in sewers, ditches, canals, and rivers; measurement of water power; water wheels of various types. Text-book: Merriman, *Hydraulics*. Open to students who have taken Civil Engineering 1, 2, and Mathematics 4. Four hours. First semester. Four units.

## 13. Irrigation Engineering.

ASSISTANT PROFESSOR KELTON

Engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measuring, and pumping water for use in irrigation. Open to students who have taken Civil Engineering 1, 2, 11, 14. Two hours and one three-hour laboratory and drafting period. This course may be given as a consultation subject. First semester. Three units.

## 14a. Mechanics of Materials.

ASSISTANT PROFESSOR KELTON

Analysis and computation of stresses in prisms, beams, columns, and shafts. Text-book: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6. Three hours. Second semester. Three units.

## 14b. Materials Testing.

MR. MICOTTI

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil Engineering 14a. One three-hour laboratory period. Second semester. One unit. Two units additional may be elected, hours to be arranged.

## 15. Contracts and Specifications.

PROFESSOR WATERBURY

Essentials of a contract; items included in various kinds of engineering contracts and specifications; preparation of a complete set of specifications and a contract. Text-book: Johnson, *Engineering Contracts and Specifications*. Open to all students. This course may be given as a consultation subject. Two hours. First semester. Two units.

## 16. Thesis.

PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student is permitted to register in this subject unless his previous work has been of high grade. Open to Senior students in civil engineering. First or second semester. Two units.

## 17. Public Water Supplies.

PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water; methods of purification of water; and a study of the design of water systems. Text-books: Turneaure and Russell, *Public Water Supplies*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject. Two hours. First semester. Two units.

## 18. Sewerage.

ASSISTANT PROFESSOR KELTON

Methods of sewerage purification; sewerage disposal plants; and design of sewer systems. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject. Three hours. Second semester. Three units.

## 19. Elementary Surveying.

ASSISTANT PROFESSOR KELTON

Chaining, compass, level, and transit work; land surveying, traversing, and computations. This course is parallel to Civil Engineering 1, and is offered especially for agricultural, mechanical and electrical



engineering students. Prerequisite, Mathematics 1b or its equivalent. One lecture-recitation period and one three-hour field period. First semester. Two units.

20a. Elementary Surveying (Continued).

ASSISTANT PROFESSOR KELTON

A continuation of Civil Engineering 19. Canal surveying, elementary topographic surveying, etc. This course includes instruction in field measurement of water by means of weirs, floats, and current meter. For agricultural, mechanical and electrical engineering students. One lecture-recitation period and one three-hour field or laboratory period. Second semester. Two units.

20b. Irrigation.

ASSISTANT PROFESSOR KELTON

Duty of water, its development, diversion, measurement, and application to land. Offered especially for agricultural students, to be taken in connection with Civil Engineering 20a. One lecture-recitation period. Second semester. One unit.

22. Highway Engineering.

PROFESSOR WATERBURY

Highway location and construction; construction of city pavements; bituminous materials for dust prevention and road preservation. Prerequisite, Civil Engineering 1. Two hours. Second semester. Two units.

101. Architectural Drawing and Design. PROFESSOR WATERBURY

Elements of architecture; walls, mouldings, doors, windows, roofs, stairs; orders of architecture; rendering; order problems; shades and shadows. Prerequisite, Mech. Arts 1, 2. One hour lecture and recitation, and six hours of drafting. First semester. Three units.

102. Architectural Design.

PROFESSOR WATERBURY

Rendered problems involving simple composition; library research; sketch problems. Prerequisite, Civil Engineering 101. Nine hours drafting. Second semester. Three units.

## CLASSICAL LANGUAGES

ASSISTANT PROFESSOR NEWSOM

### GREEK

1, 2. Beginner's Course.

White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books). Four hours. Both semesters. Four units, each semester.

3, 4. Homer, Plato, and Lysias.

Homer, *Iliad* (first four books); Plato, *Apology and Crito*; and selections from Lysias. Four hours. Both semesters. Four units, each semester.

LATIN

The courses below are open to students who have completed the first three years of Latin.

1, 2. Livy and Cicero.

Livy, Selections; Cicero, *de Senectute, de Amicitia*. Exercises in prose composition. Four hours. Both semesters. Four units, each semester.

3, 4. Tacitus and Horace.

Tacitus, *Germania and Agricola*; Horace, *Odes* and selections from *Epodes*. Three hours. Both semesters. Three units, each semester.

5, 6. Cicero, Horace, and Tacitus.

Cicero, *Letters*; Horace, *Letters*; Tacitus, selections from *Histories*. Three hours. Both semesters. Three units, each semester.

EDUCATION

PROFESSOR VON KLEINSMID, ASSISTANT PROFESSOR NEAL

The work of this department is planned to meet the needs of those especially who are preparing to enter the teaching profession as high school teachers, principals, and superintendents; to offer such fundamental courses as will afford the proper foundation and training for higher degrees; and so to present the material of educational history, science, and philosophy as to make for broad culture in any student whether he intends to become a teacher or not.

The work of this department, the observation work in the public schools, and the courses in the teaching of high school subjects which are offered in this and any other department of the University, fully meet the requirements for certification as laid down by the school laws of the State of Arizona.

Only those who desire to prepare for active work in teaching or supervising, and whose preparation and experience are satisfactory to the department, will be accepted as major students in Education. The department recommends that regular students who expect to teach should defer their work in Education until the Junior year.

As fundamental to most courses in this department, students should do the work of courses 1 and 2 in Education and course 9 in Psychology.

Students in this department have access to more than one thousand books, pamphlets, and bound periodicals, carefully selected, to bear directly upon the courses outlined. All of the leading educational periodicals in current numbers, also, are to be found upon the library shelves. In addition, the current publications and bulletins of the United States Bureau of Education, are to be found in the reference library.

1. History of Education.

A general survey of the development of educational theories and institutions to the beginnings of modern realism. Special attention given to the general bearing of these theories upon present day educational problems. Three hours. First semester. Three units.

2. History of Education.

Continuation of Education 1, but may be begun in the second semester. A survey of the development of educational theories and institutions from the beginning of modern realism to the present time with a brief study of the origin and growth of the American school system. Three hours. Second semester. Three units.

3. Principles of Education.

A study of the general problems of education, together with the means and methods of their solution in the light of the fundamental principles of mental development. Three hours. First semester. Three units.

4. Principles of Education.

A continuation of Education 3, but may be begun in the second semester. Three hours. Second semester. Three units.

5. Vocational Education.

A review of the historic types of training for vocation, together with a consideration of the problems and principles of vocational education of the present. This course offered in 1915-16 but not in 1916-17. Two hours. First semester. Two units.

6. Secondary Education.

The fundamental principles of organization, classification, and instruction in their bearing upon the practical problems of secondary education. Three hours. Second semester. Three units.

### 7. Philosophy of Education.

A study of the fundamental phases of education in relation to science and philosophy and an attempt to mark out the basic principles of the educative process. Open to those who have had eight hours in Education and Psychology 9. This course not offered in 1915-16 but offered in 1916-17. Two hours. First semester. Two units.

### 8. Comparative School Systems.

The school systems of Arizona and several other states are studied in their individual aspects and in their relation to general educational conditions in the United States. Upon this basis the course is completed by a comparative study of the school systems of Prussia, France, England, and Canada. This course offered in 1915-16 but not in 1916-17. Two hours. Second semester. Two units.

### 9. Education in Religion and Morals.

A consideration of the necessity and the methods of religious and moral training through the periods of childhood and adolescence. Open to those who have had eight hours in Education and Psychology 9. Two hours. First semester. Two units.

### 10. Social Aspects of Education.

A study of the relation of social needs, desires, and forces to the teaching, organizing, and administrative factors in education. It is strongly recommended that students do some work in principles of sociology or social psychology before taking this course. Open to those who have had eight hours in Education and Psychology 9. This course not offered in 1915-16 but offered in 1916-17. Two hours. Second semester. Two units.

### 11. Educational Method and Practice.

The intensive study of the teaching of some one subject of the curriculum, including readings, lectures, reports, and either the observation of or practice in the teaching of the subject. Open only to those having permission of professor in charge. Should be preceded by Education 1, 2.

### 12. Educational Method and Practice.

Similar to Education 11 except that a different subject is made the basis for the work of the course. Should be preceded by Education 3, 4. Open to those who have permission of professor in charge. Two hours. Second semester. Two units.

## 13. Educational Psychology.

The application of the principles of psychology to education. Open to those who have had eight hours in Education and Psychology 9. Two hours. First semester. Two units.

## 14. Educational Psychology.

A continuation of Education 13. Two hours. Second semester. Two units.

## 15. Educational Seminarium.

A review of educational literature, including current educational periodicals. Open to all students registered in the department. First semester. One unit.

## 16. Educational Seminarium.

A continuation of Education 15, but may be begun in the second semester. Open to all students registered in the department. Second semester. One unit.

## ELECTRICAL ENGINEERING

PROFESSOR HENLEY AND MR. FITZGERALD

Work in electrical engineering proper is not undertaken until the Junior year. Courses are given in other engineering subjects, and electives give opportunity for work along non-engineering lines.

## 1. Direct Currents.

MR. FITZGERALD

The construction, theory, and principles of operation of direct current motors and generators. A thorough study of their characteristics under various conditions, and their application for different classes of work. The study of storage batteries and other direct current auxiliaries. Three one-hour lecture periods. Second semester, Junior year. Three units.

## 2. Alternating Currents.

MR. FITZGERALD

The theory of alternating currents. A study of alternating current machinery including: alternators, synchronous motors, rotary converters, transformers; induction, repulsion, and series motors. This is taken up in a manner similar to direct current machinery. One three-hour period in the laboratory devoted to the study of electrical



instruments, their calibration, and electrical measurements. Three one-hour lecture periods, and one three-hour laboratory period. First semester, Senior year. Four units. Laboratory fee \$3.

3. Illumination and Distribution. MR. FITZGERALD

Cost of producing and transmitting power for lighting purposes, different methods of distribution and their advantages under various conditions, comparing different light sources and their relative value for diverse purposes, the effect and selection of shades. Two one-hour lecture periods. Second semester, Senior year. Two units.

4. Electric Traction. MR. FITZGERALD

Traffic and schedule studies, selection of equipment, transmission of energy, location of substations and central plant, electrolysis, track lay-out and construction, signal and dispatching systems, construction and equipping of rolling stock, and comparison of alternating current and direct current traction. Two one-hour lecture periods. Second semester, Senior year. Two units.

5, 6. Electrical Engineering Laboratory. MR. FITZGERALD

Operation and characteristics of commercial machines and allied apparatus, making complete tests of generators, alternators, synchronous converters, and common causes of trouble and their remedy. Two three-hour laboratory periods. Both semesters, Senior year. Two units, each semester. Laboratory fee \$3, each semester.

7. Design of Electrical Machinery. MR. FITZGERALD

Practical problems in design applying the theory and empirical relations illustrated in practice, and effect of design on characteristic and performance of direct current and alternating current machinery. Two three-hour draughting room periods and one one-hour lecture period. First semester, Senior year. Three units. Drawing fee \$1.

8. Electric Station Design. MR. FITZGERALD

Selection and arrangement of electric power station equipment, wiring diagrams and switch board connections, transmission line design, calculations of cost of operation, estimated cost of power delivered and power rates. Two one-hour lecture periods, and one three-hour draughting room period. Second semester, Senior year. Three units. Drawing fee \$1.

## 9. Electrical Engineering Practice.

MR. FITZGERALD

A general course for all engineering students, covering the greater part of the electrical field, so as to give a broad idea of the principles and practice of electrical engineering. One three-hour period in the laboratory in the actual operating and testing of generators and motors. Two one-hour lecture periods, and one three-hour laboratory period. First semester, Junior year. Three units. Laboratory fee \$3.

## 10. Seminar.

MR. FITZGERALD

Discussion of various subjects which arise in connection with work, and review of current engineering literature. One one-hour lecture period. First semester, Senior year. One unit.

## ENGLISH COMPOSITION AND RHETORIC

PROFESSOR PERRY

## 1. Exposition.

Lectures and the study and practice of Exposition; daily and weekly themes. Prescribed for Freshmen. Three hours. First semester. Three units.

## 2. Argumentation.

The study and practice of Argumentation. Class debates and written arguments, instruction in the right use of authorities, use of catalogues, and indexes. Prescribed for Freshmen. Three hours. Second semester. Three units.

## 11, 12. Methods of Teaching English.

For students preparing to teach English in secondary schools. Methods of teaching grammar, rhetoric, composition, literature; discussion of college entrance requirements in English; blocking out courses, and planning and presenting single lessons. Open to Juniors and Seniors. Not offered in 1915-1916 but offered in 1916-1917. Three hours. Both semesters. Three units, each semester.

## 20. Narration.

The writing of short-stories; consideration of the problems of the short-story writer; the discovery, through the analysis of specimen stories, of helpful principles and devices, and experimentation in their application in short-story writing; frequent themes. Open to college

students who have successfully completed English 1, 2. Offered 1915-1916 but not offered 1916-1917. Three hours. First semester. Three units.

## 21. Public Speaking.

A practical course intended to correct faults in delivery, establish sound standards of oratory, and train students in easy, effective oral expression. Constant class-room practice in informal debates and in other forms of public speaking. Open to students who have finished English 1, 2. Three hours. First semester. Three units.

## 22. Modern English Prose Style.

A theme course based on the study of models. Open to college students who have successfully completed English 1, 2. Not offered 1915-1916 but offered 1916-1917. Three hours. Second semester. Three units.

# ENGLISH LITERATURE

PROFESSOR BATES AND ASSISTANT PROFESSOR LUTRELL

## 3, 4. History of English Literature. PROFESSOR BATES

An outline of English literature from its beginning down to the present time. Text-book: Moody and Lovett, *History of English Literature*. Assigned readings from numerous authors. This course is preliminary to all other courses in English literature. Two hours. Both semesters. Two units, each semester.

## 5, 6. Elizabethan Drama. PROFESSOR BATES

Development of the Elizabethan drama from the Miracle Plays, Moralities, and Interludes; the Senecan influence, the work of Lyly, Greene, Peele, Kyd, and Marlowe; a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama. Lectures and discussions. A play is usually given at Commencement by the members of this class. Three hours. Both semesters. Three units, each semester.

## 7. Nineteenth Century Literature. The Romantic Period.

PROFESSOR BATES

The historical development of the romantic spirit and its manifestation in the poetry of Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats; the essays of Lamb, Hazlitt, De Quincey, and Emerson;

the fiction of Scott, Hawthorne, Poe, Charlotte Bronte, and Emily Bronte. Five hours. First semester. Five units.

8. Nineteenth Century Literature. The Victorian Period.

PROFESSOR BATES

The change of spirit in the Victorian era; the work of the typical Victorians: Tennyson, Macaulay, Dickens, Thackeray, and Eliot; the various forms of revolt in Arnold, Browning, Rossetti, Swinburne, Morris, Carlyle, Ruskin, Meredith, Hardy, and Stevenson. Five hours. Second semester. Five units.

9, 10. Principles of Literary Criticism.

PROFESSOR BATES

An historical study of the chief theories of literary criticism to aid the student in forming satisfactory principles of judgment for himself. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics. Primarily for Seniors. Two hours.

15, 16. Contemporary Literature.

PROFESSOR BATES

Such a study of British and American literature in the last quarter-century as will enable the student to form a clear estimate of present-day tendencies: the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of Francis Thompson, Dowson, Symons, Henley, Yeats, and Hovey; in the prose of Kipling, Bennett, Wells, Grierson, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, Phillips, and Synge. Lectures, discussions, and quizzes. Two hours. Both semesters. Two units, each semester.

17, 18. Chaucer.

ASSISTANT PROFESSOR LUTRELL

A large part of the *Canterbury Tales* is read, the *Prologue of the Legende of Gode Wommen*, and some of the minor poems. A purely literary course; a knowledge of Anglo-Saxon is not required. Three hours. Both semesters. Three units, each semester.

25. Use of Books and Elementary Bibliography.

ASSISTANT PROFESSOR LUTRELL

Classification, card catalogues, the more common reference books, bibliographies, indexes, dictionaries, cyclopedias. Open to Freshmen

and Sophomores. Lectures, exercises, preparation of bibliographies. Two hours. First semester. Two units.

26. The Library and the School. ASSISTANT PROFESSOR LUTRELL

Library administration, small school libraries, selection and ordering of books, sales catalogues, library routine. Primarily for students intending to teach. Lectures and practice work. Two hours. Second semester. Two units.

## FRENCH

(See Romance Languages)

## GEOLOGY

PROFESSOR CLAPP

The courses in Geology, with the exception of 13 and 14 are intended for students in mining and applied geology. The advanced courses are offered primarily for those students who wish to take up geology as a profession, or who are engaged in geological research. They provide opportunities for study in the unexcelled geological field of Southern Arizona, which affords problems of great diversity in superficial, sedimentary, igneous, and metamorphic rocks and in ore deposits, and where field work may be carried on at any time of the year.

### 1, 2. General Geology.

The fundamental principles of geology, preparing for the more detailed courses to follow. First semester, dynamical geology: the geological work of the atmosphere, surface and underground waters, of snow and ice, of earth movements, and of vulcanism. Lectures and recitations, and the interpretation of topographical and geological maps in the laboratory. Second semester, structural geology and the origin and classification of rocks, and briefly historical geology. Continued study of topographical and geological maps; structural problems; the field classification and macroscopic study of rocks, and the fundamentals of geological mapping; and short field trips in the vicinity of Tucson. Prerequisite, Chemistry 1, 2, and Mineralogy 1, which may be taken simultaneously. Two hours and one three-hour laboratory period. Both semesters. Three units, each semester.



### 3. Elementary Economic Geology.

A course in the distribution, geological features, and origin of mineral deposits, including both metallic and non-metallic products, especially of those of North America. Prerequisite, Geology 1, 2, and Mineralogy 4. Three lecture hours. First semester. Three units.

### 4. Economic Geology.

A course in the more theoretical aspects of the geology of ore deposits, including structural features, the transportation and deposition of minerals, the alteration of wall rocks, classification of ore deposits, and secondary enrichment. The laboratory work consists of the petrographic study of wall rocks and their alterations, and the macroscopic, petrographic, and metallographic study of polished surfaces of ores. Prerequisite, Geology 3 and Mineralogy 5. Mineralogy 6 taken simultaneously. Two lecture hours and one three-hour laboratory period. Second semester. Three units.

### 5, 6. Field Geology.

A course in the various methods of geological surveying, including detailed plane table, pacing traverse, reconnaissance, and underground methods. Geological maps are not only prepared but material for laboratory study is collected and geological reports are prepared. During the second semester the student works more independently investigating some selected district. Prerequisite, Geology 1, 2. Geology 3, 4 taken simultaneously. Three three-hour laboratory periods. Both semesters. Three units, each semester.

### 7. Introductory Paleontology.

The general principles of paleontology, and the structure, relationships, and geological significance of the principal types of fossil invertebrates and plants. No attempt is made to describe or identify specific fossils, but instruction is given in methods of collecting fossils and of preparing them for identification by a trained paleontologist. Prerequisite, Geology 1, 2, or 13, 14. Two hours. First semester. Two units.

### 8. Geology of North America.

A course in the general physiography, stratigraphy, and structural and igneous geology of North America, with especial reference to Arizona. Prerequisite, Geology 1, 2, or 13, 14. Two two-hour lecture-laboratory periods. Second semester. Two units.

9, 10. Advanced Economic Geology.

For graduate students in economic geology, especially for those who wish to work on one of the many varied problems in ore deposits afforded by the mining districts of Arizona. Each student selects his own problem, based either on the laboratory study of material on hand or preferably on material gathered by the student in the field. The work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

11, 12. Advanced Field Work.

For graduate students. Mapping an area in Arizona selected for the study of some particular problem in physiography, structural geology, petrology, or ore deposits. The problem selected is studied in detail, and the results presented in form for publication.

13. Dynamical Geology and Physiography.

For students in general arts and science, to familiarize them with the geological processes, erosion, transportation, sedimentation, deformation and eruption, and with the development and sculpturing of land forms. Lectures, illustrated by maps, diagrams, specimens, and stereopticon. Prerequisite, Chemistry 1, 2, or Entrance Chemistry. Two hours. First semester. Two units.

14. Historical Geology and Evolution.

A continuation of Geology 13. A general view of the past history and evolution of the earth and of its life as recorded by the sedimentary rocks and their enclosed fossils. Prerequisite, Geology 13. Two hours. Second semester. Two units.

## GERMAN

ASSISTANT PROFESSOR OTIS

1, 2. Elementary German.

First semester: Mosher's *Lern- und Lesebuch* used as basis for work in grammar and composition. Second semester: Mosher's *Lern- und Lesebuch* completed and reviewed as basis for conversation. Grammar reviewed with P. V. Bacon's *German Grammar*. Reading of Storm's *Immensee*. Five hours. Both semesters. Four units, each semester.

## 3, 4. Advanced German.

First semester: P. V. Bacon's *German Composition*. Reading of Meyer-Foerster's *Karl Heinrich*, and Schiller's *William Tell*. Conversation based on Manley's *Ein Sommer in Deutschland*. Second semester: Bacon's *German Composition* completed. Reading of Sudermann's *Frau Sorge*; Heine's poems and *Die Harzreise*; Schefel's *Ekkehard*. Conversation based on Manley's *Ein Sommer in Deutschland*. Prerequisite, German 1, 2. Five hours. Both semesters. Four units, each semester.

## 3a, 4a. Advanced German for Students Entering with Two Years of High School German.

German conversation and conversation identical with that work in German 3, 4. Three hours. Both semesters. Two units, each semester.

## 5, 6. Life and Works of Lessing, Goethe, and Schiller.

First semester: Lessing; study of life of Lessing, of *Emilia Galotti*, and of *Nathan der Weise*. Study of life of Schiller, and of *Maria Stuart*. Second semester: Study of Schiller's *Die Jungfrau von Orleans*; Goethe; study of life of Goethe, of *Hermann und Dorothea*, of *Goetz von Berlichingen*, and of *Iphigenie auf Tauris*. Prerequisite, German 3, 4. Three hours. Both semesters. Three units, each semester.

## 5S, 6S. Reading and Conversation in Scientific German.

Text: Dippold's *Scientific German Reader*. Prerequisites, one year of Chemistry and one of Physics; German 3, 4 or may be taken with German 3, 4. Two hours. Both semesters. Two units, each semester.

## 7, 8. German Literature in the Nineteenth Century.

First semester: The Romanticists and their successors. Reading of works of Kleist and Grillparzer. Second semester: The rise of Naturalism and Symbolism. Reading of works of Wildenbruch, Fulda, Sudermann, and Hauptmann. Prerequisite, German 3, 4. Two hours. Both semesters. Two units, each semester.

## 9, 10. Methods, Theory, and Practice of Teaching German.

Observation of methods used in teaching German, reports and discussions on these observations. Lectures to develop ideas of teaching

German, especially in secondary schools. Prerequisite, German 5, 6, or may be taken with German 5, 6. One hour. Both semesters. One unit, each semester.

11, 12. Goethe's *Faust*.

First semester: A close study of Goethe's life and of *Faust*, Part I. Text: Goethe's *Faust*, edited by Calvin Thomas, Part I. Second semester: Goethe's *Faust*, Part II. Text: Goethe's *Faust*, edited by Calvin Thomas, Part II. Prerequisite, German 5, 6. Two hours. Both semesters. Two units, each semester.

13, 14. History of German Literature.

Lectures and selected readings to show the development of German literature to the nineteenth century. This course is required of all students majoring in the Department of German. Prerequisite, German 5, 6. Two hours. Both semesters. Two units, each semester.

## GREEK

(See Classical Languages)

## HISTORY AND ARCHAEOLOGY

ASSISTANT PROFESSOR HUBBARD AND ASSISTANT PROFESSOR REID

1, 2. Expansion of the American People.

ASSISTANT PROFESSOR REID

The political and social development of the American people from the settlement of the Atlantic seaboard to the present time; the analysis of the various complex forces which have resulted in the ideas and institutions of the day; the adaptation of European peoples and institutions to American conditions; the early westward movement; the development of western democracy; the social and political changes following the Civil War; the settlement of the far West. Open to all students. Three hours. Both semesters. Three units, each semester.

3, 4. Mediaeval History.

ASSISTANT PROFESSOR REID

A history of Europe from the fall of the Roman Empire in the West to the time of the Reformation; the origin and development of the various European states; the origin, growth, and significance of the religious, social, and political institutions of the period. Three hours. Both semesters. Three units, each semester.

## 5, 6. Nineteenth Century Europe.

ASSISTANT PROFESSOR HUBBARD

The liberal and reform movements of Europe during the last century; the evolution of constitutional government; various movements toward national unity; the rise of modern Italy; the Franco-Prussian war; the rise of modern Germany; English reform bills of 1832, 1867, and other political developments. Three hours. Both semesters. Three units, each semester.

## 7, 8. Constitutional History of the United States.

ASSISTANT PROFESSOR HUBBARD

Formation of the Union, political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents, and special histories. The purpose of the course is to direct the student to collect and organize source material. Open only to students having had History 1, 2. Three hours. Both semesters. Three units, each semester.

## 9. Greek History.

ASSISTANT PROFESSOR REID

The history of Greece to the death of Alexander. A study of the development of the political, social, and economic life of the Greek people. Three hours. First semester. Three units.

## 10. Roman History.

ASSISTANT PROFESSOR REID

The history of Rome to the fall of the Empire. A survey of the political history as a basis for the study of the organization of the Republic and the Empire; the social and economic development of the people. Emphasis will be placed upon the relation of Rome to the Mediterranean World. Three hours. Second semester. Three units.

## 11. Development of the English Nation.

ASSISTANT PROFESSOR HUBBARD

The English people from the earliest times to the end of the Tudor period. The influence of Church and Continental relations; the causes and events relative to the development of English social and political institutions. The student is expected to have a clear idea of the Constitution as developed to the close of the period. Three hours. First semester. Three units.



## 12. Development of English Party Government.

ASSISTANT PROFESSOR HUBBARD

Beginning with the close of the Tudor period, a study of the events and legislation causing and directing the growth of English political parties. The prerogatives of the crown, the development of the cabinet system, elections, methods of legislation, and the reform bills of the nineteenth century. Three hours. Second semester. Three units.

## 13, 14. Modern Europe.

ASSISTANT PROFESSOR HUBBARD

European history from the Reformation to the Napoleonic period. European civilization of the seventeenth and eighteenth centuries. Second semester: an intensive study of the French Revolution. Not offered 1915-16. Three hours. Both semesters. Three units, each semester.

## 15. The Balkan War.

ASSISTANT PROFESSOR HUBBARD

A study of the Balkan States; causes and events of the late war; a study of the diplomacy resulting therefrom. Open to students having had one course of college history. Two hours. First semester. Two units.

## 16. The Great European War.

ASSISTANT PROFESSOR HUBBARD

An introductory study of the great European powers in the twentieth century; immediate causes, events, and international problems of the great war. Open to students having had one course of college history. Two hours. Second semester. Two units.

## 20. European Archaeology.

Interpretations of archaeological monuments covering classical life and literature. Three hours. First semester. Three units.

## 21. American Archaeology.

An investigation of the remains of prehistoric races on the American Continent. Three hours. Second semester. Three units.

## HOME ECONOMICS

## 1, 2. Elementary Food Preparation.

A general survey of the principles of cookery, a development of skill in the technique of cookery, and a working knowledge of house-

hold process connected with food. \*Prerequisite, Chemistry 1, 2 or an equivalent. One lecture, two three-hour laboratory periods. Both semesters. Three units, each semester. Laboratory fee \$5, each semester.

3, 4. Food Economics.

The quantitative aspect of cooking processes, a comparative study of foods, and the cost of materials involved. Prerequisite, Home Economics 1, 2. Prerequisite or parallel, Chemistry 23 and Chemistry 3. One lecture, two three-hour laboratory periods. Both semesters. Three units, each semester. Laboratory fee \$5, each semester.

†5, 6. Demonstration Cookery, Home Cookery, and Table Service.

A course giving practice in public demonstration lectures, useful for general teaching, for instruction in farmers' institutes, women's clubs, settlements, and other fields. It includes also practice in home cookery, the planning, preparation, and serving of breakfasts, luncheons, dinners, and suppers. This course should be elected by all students majoring in Foods and Cookery. Prerequisite, Home Economics 1, 2, 3, 4. Prerequisite or parallel, Chemistry of Foods, Bacteriology, and Zoology 4, 5 (Physiology). One lecture, two three-hour laboratory periods. Both semesters. Three units, each semester. Laboratory fee \$5, each semester.

7, 8. Dietetics.

A survey of the nutritive values of foods and the food requirements of the individual throughout life. Diets for different ages and conditions are worked out in the laboratory. Prerequisite, Home Economics 1, 2, 3, 4. Prerequisite or parallel, Chemistry of Foods, Bacteriology, and Zoology 4, 5 (Physiology). Two lectures, one three-hour laboratory period. Both semesters. Three units, each semester. Laboratory fee \$2, each semester.

9, 10. House Planning, Furnishing, and Decoration.

A study of house plans of various types, the artistic and economic furnishing, the principles of harmony in design and color applied in decorations. Prerequisite or parallel, Drawing. Two lectures, one three-hour laboratory period. Both semesters. Two units, each semester.

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\*Students may take H. E. 1, 2 as a free elective, substituting one year of Science for Chemistry 1, 2.

†Home Economics 5, 6 should be elected by all students majoring in Foods and Cookery.

11, 12. Theory and Practice of Teaching Foods and Cookery.

Not offered in 1915-16.

13, 14. Elementary Clothing and Hand Work.

This course gives practice in the use of sewing machines and their attachments, the making of the fundamental stitches, the drafting and use of patterns, making of simple garments, darning, patching, and simple embroidery. The course is prerequisite for all Textile and Clothing courses except Millinery. Lectures, recitations, laboratory work. Two three-hour periods. Both semesters. Three units, each semester. Laboratory fee \$2, each semester.

15, 16. History of Costume and Costume Design.

Not given in 1915-16.

17. Drafting, Draping, and Pattern Making.

Practice in drafting, cutting, fitting, and designing sleeves, collars, waists, skirts, and gowns. Prerequisite, Home Economics 13, 14. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$5.

18, 19. Dressmaking.

The making of waists, dresses, and trimmings. Prerequisite, Home Economics 13, 14, 17. Two three-hour laboratory periods. Both semesters. Two units, each semester.

20, 21. Advanced Dressmaking.

Not offered in 1915-16.

22, 23. Millinery.

A course giving instruction in making wire frames, buckram and cape net frames, hats, renovating old materials, manufacturing artificial flowers and other trimmings. Two three-hour laboratory periods. Both semesters. Two units, each semester. Laboratory fee \$2, each semester.

24. Textiles.

(a) The identification of fibres and their substitutes by means of the microscope and chemical tests. Hours to be arranged. Prerequisite or parallel, Bacteriology and Zoology 4, 5 (Physiology).

(b) Textile Manufacture.

Not offered 1915-16.

25, 26. Theory and Practice of Teaching Textiles and Clothing.

Not offered 1915-16.

## LATIN

(See Classical Languages)

## LAW

Courses in this department are open only to such students as have thirty units of academic credit.

## 1. Introduction to the Study of Law.

Nature, origin, evolution, and sources of law; a history of English and American law, together with a discussion of the methods of legal study. First semester. Three units.

## 2. Contracts.

Offer and acceptance; requisites of contracts under seal; express and implied conditions; illegality; impossibility of performance; discharge of contracts. First semester. Three units.

## 3. Contracts.

A continuation of course 6. Second semester. Three units.

## 4. Torts.

Trespass; excuses for trespass; negligence of duties of land owners; hazardous occupations; liability for animals; malicious persecution; competition; strikes and boycotts; business combinations. First semester. Three units.

## 5. Agency.

Relation; appointment; liabilities of principal; liabilities of agent; parties to writings; undisclosed principal; delegation and termination of agency. Second semester. Three units.

## 6. Property.

Distinction between real and personal property; acquisition of rights in personal property; gifts; bailment; lien; pledge; real property; tenures; estates; seisen and conveyances; incidents of ownership in real property; fixtures; easements; covenants as to use; public rights; franchises; rents. First semester. Two units.

## 7. Property.

A continuation of course 6. Second semester. Three units.

### 8. Criminal Law.

Nature and sources of criminal law; the criminal act; attempts; criminal intent; circumstances affecting illegality of act; specific offenses; crimes against property; conspiracy. First semester. Three units.

### 9. Common Law Pleading.

A general survey of the principles of common law pleading, followed by a consideration of the more important forms of action. Second semester. Three units.

### 10. Equity.

Nature of jurisdiction; specific performance of contracts; partial performance; consideration; marketable title; bills for an account; specific prevention; specific reparation of torts; injunctions for waste; trespass; nuisance; infringement of patents and copyrights; interference with business relations; violations of rights of privacy. First semester. Two units.

### 11. Equity.

A continuation of course 10. Second semester. Two units.

### 12. Property.

A continuation of course 7. First semester. Three units.

### 13. Constitutional Law.

Nature and sources of American constitutional law; express powers, implied powers; citizenship; privileges and immunities of citizenship; due process of law; police power; regulation of commerce; money; war. Second semester. Three units.

### 14. Municipal Corporations.

Nature and functions; creation, alteration, and dissolution; legislative control; powers and duties of directors; rights of stockholders; forfeiture of charter. First semester. Two units.

### 15. Conveyances.

Accretion; prescription; creation of interests in land by agreement or conveyance; methods of transfer of interests at common law and under statutes; execution of deeds; interpretation of instruments of conveyance; covenants for title; conditions; fraudulent conveyances. Second semester. Two units.



## 16. Conflict of Laws.

The principles and rules of "private international law;" a study of the nature and effect of domicile and nationality; jurisdiction of courts in proceedings; respective applicability and effect of domestic laws and foreign laws in marriage and other domestic relations; contractual, quasi-contractual, delictual, and judgment obligations; property interests. First semester. Three units.

## 17. Quasi-Contracts.

Origin and nature; benefits conferred in misreliance on right or duty, misreliance resulting from mistake of law, misreliance on invalid contract, on illegal contract, on unenforceable contract; benefits conferred through dutiful intervention in another's affairs; benefits conferred under constraint, constraint of duress, of legal proceedings, of tax or assessment; action for restitution as alternative remedy for breach of contract and for tort. Second semester. Three units.

## 18. Evidence.

Functions of judge and jury; presumptions; burden of proof; judicial notice; classification of evidence; admissions; principles and rules relating to misleading or unimportant matters; character; confessions; hearsay; witnesses' opinions; expert testimony; evidence relating to execution, contents, and interpretation of writings; real evidence; rules of substantive law; competency of witnesses; privilege, impeachment, confirmation, and examination of witnesses. First semester. Three units.

## 19. Evidence.

A continuation of Course 18. Second semester. Three units.

## 20. Persons and Domestic Relations.

Marriage: promise to marry and breach; marriage as a contract or relation; annulment; divorce; separation. Parent and child: custody, support, services and earnings of child, relation as to torts. Infants: period of infancy; voidable acts; disaffirmance. Husband and wife: rights of each as to the property, earnings, services, and society of the other; husband's duty to support wife and wife's authority to bind husband by contracts; contracts, conveyances, and devises of married women; liability of married women for torts and responsibility for crimes. First semester. Two units.

## 21. Sales.

Subject matter of sales; executory and executed sales; bills of lading; seller's lien and right of stoppage *in transitu*; fraud; factor's acts; warranty and remedies for breach of warranty; Statute of Frauds. Second semester. Two units.

## 22. Suretyship.

Personal suretyship compared with real suretyship; suretyship obligations compared with insurance and indemnity obligations; guaranty and other forms of suretyship in relation to the Statute of Frauds; suretyship in transactions involving negotiable instruments; fidelity contracts and judicial bonds; surety's defenses due to original defects in his obligation or to its subsequent discharge; surety's right to subrogation, indemnity, contribution, or exoneration; creditor's right to surety's securities. First semester. Three units.

## 23. Damages.

Respective functions of court and jury in estimating damages; exemplary, liquidated, nominal, direct, and consequential damages; avoidable consequences; counsel fees; certainty, compensation, damages for non-pecuniary injuries; value; interest and damages in certain actions of tort and contract. Second semester. Two units.

## 24. Bailments and Carriers.

Bailments in general; special classes of bailments involving ordinary liability, exceptional liability, innkeepers, common carriers of goods, common carriers of passengers. First semester. Three units.

## 25. Bills and Notes.

A consideration of bills of exchange, notes, and checks, including formal requisites, acceptance, endorsement, transfer, extinguishment, obligation, diligence, specialty character. Second semester. Three units.

## 26. Partnership.

Nature, purposes, and members; creation of partnerships; nature of partner's interest; firm name and goodwill; mutual rights and duties; actions between parties at law and in equity; powers of partners; liability for acts of partners in contract and tort; general liability; dissolution and notice; consequences of dissolution; dissolution agreements; distribution of assets; limited partnerships. First semester. Three units.

## 27. Mortgages.

Essential elements of legal and equitable mortgages; rights of mortgagor and mortgagee at law and in equity; title, possession; dower, curtesy; waste; priorities; collateral agreements; foreclosure; redemption; extension; assignment and discharge. Second semester. Two units.

## 28. Wills and Administration.

Acquisition of property on death of former owner, escheat, descent, occupancy, the making, revocation, and republication of wills, payment of legacies and distribution; ademption and lapse of legacies. First semester. Two units.

## 29. Water Rights and Irrigation Law.

Irrigation at common law; other systems of irrigation law; appropriations; basis of right of appropriation; patentees and appropriators; waters subject to appropriation; priorities; transfer of water rights. Second semester. Two units.

## 30. Mining Law.

A study of mining titles with reference to mining rights. First semester. Two units.

## 31. Bankruptcy.

Jurisdiction of the United States and the States; who may be a bankrupt; who may be petitioning creditors; acts of bankruptcy where property passes to the Trustee; provable claims; protection; exemptions and discharge. Second semester. Two units.

## 32. Future Interests.

Vested and executory interests; rule against perpetuities; provisions for forfeiture and restraint on alienation. First semester. Two units.

## 33. Insurance.

Marine, fire, and life insurance. Insurable interest in various kinds of policies; concealments; misrepresentations; warranties; amount of recovery; subrogation; powers of agents, assignees, and beneficiaries. Second semester. Two units.

## 34. Private Corporations.

The nature, formation, and organization of corporations; irregular incorporation; corporate powers; promoters; directors and share-

holders; creditors; stock issue and payment; transfer. First semester.  
Three units.

### 35. Public Utilities.

The nature, rights, and duties of public service callings; railroads and canals; telephone and telegraph; gas, water, and other public utilities. Second semester. Three units.

The Case method, supplemented by lectures and text-books is used, with the aim of furnishing the students in the Department of Law with such training as will best fit them for the practice of law. The courses are so presented as to familiarize the student with legal methods of reasoning and to train him in legal habits of thought. Courses are open to both men and women regularly entered as students in the College of Letters, Arts, and Sciences.

A practice court is an organized part of the department, with the purpose of affording the student practical instruction in pleading and practice.

By taking a combined course in collegiate and law studies it is possible for students to shorten from seven to six years the time required to earn the degrees of Bachelor of Arts and Bachelor of Laws.

Students in law may enter either as candidates for the degree of Bachelor of Laws or as special students if not qualified to become candidates for degrees.

The requirements for admission to the course for the degree of LL. B. are the same as those governing entrance to other departments of the College of Letters, Arts, and Sciences.

A graduate of an approved college may, upon presentation of diploma, enter upon strictly law courses as a candidate for a degree.

As a special student, one wishing to supplement his educational training by the study of special subjects in the Department of Law, may be admitted to certain classes by permission of the faculty.

## MATHEMATICS

ASSOCIATE PROFESSORS MEDCRAFT AND MARSHALL

1b. Trigonometry

1a. College Algebra

PROFESSORS MEDCRAFT AND MARSHALL

Courses 1b and 1a will be given as one consecutive course, to be known as Mathematics 1. About one half of the time will be de-

vated for each subject. 1b and 1a are prescribed for all engineering courses. Five hours. First semester. Five units.

Students having had Trigonometry may obtain college credit for the subject by passing a satisfactory examination, provided the same work has not been used for entrance.

2. Analytical Geometry. PROFESSORS MEDCRAFT AND MARSHALL

The fundamental methods of the subject. Prescribed for all engineering courses. Four hours. Second semester. Four units.

9. Algebra and Trigonometry. ASSOCIATE PROFESSOR MEDCRAFT

A briefer course than 1a and 1b, for those desiring a minimum amount of mathematics. Required of all candidates for the B. S. degree who do not elect 1a and 1b. Four hours. First semester. Four units.

10. Elementary Analysis. ASSOCIATE PROFESSOR MEDCRAFT

A briefer course in Analytic Geometry and Calculus. The aim of this course is to give a simple and direct introduction to those portions of mathematics beyond Trigonometry which are of most importance to the student of science, and of most interest to the general student. Required of all candidates for B. S. degree who do not elect Mathematics 2. Four hours. Second semester. Four units.

2a. Advanced Algebra. ASSOCIATE PROFESSOR MARSHALL

Continuation of Mathematics 1a. Two hours. Second semester. Two units.

2b. Spherical Trigonometry. ASSOCIATE PROFESSOR MEDCRAFT

Fundamental formulae and principles of the spherical trigonometry, with applications to astronomy. Prerequisite, Mathematics 1b. Two hours. Second semester. Two units.

3. Differential Calculus. ASSOCIATE PROFESSOR MEDCRAFT

Fundamental principles and formulae of the differential calculus, with their applications. Prescribed for Sophomores in engineering courses. Four hours. First semester. Four units.

4. Integral Calculus. ASSOCIATE PROFESSOR MEDCRAFT

The fundamental principles and formulae of the integral calculus, with their applications; including the use of tables of integrals. Prescribed for all engineering courses. Prerequisite, Mathematics 3. Four hours. Second semester. Four units.



4a. Advanced Calculus. ASSOCIATE PROFESSOR MARSHALL

A supplementary course to Mathematics 3, 4, giving special attention to special methods and applications to geometry, physics, mechanics, and other allied subjects. Two hours. Second semester. Two units.

5, 6. Analytical Mechanics. ASSOCIATE PROFESSOR MARSHALL

The mathematical treatment of the fundamental principles of dynamics, statics, etc. Prerequisites, Mathematics 3, 4. Prescribed for all engineering courses. Four hours. Both semesters. Four units, each semester.

5a. Differential Equations. ASSOCIATE PROFESSOR MARSHALL

A course in elementary differential equations, with applications to physics, astronomy, mechanics, and engineering. Two hours. First semester. Two units.

7. Higher Plane Curves. ASSOCIATE PROFESSOR MEDCRAFT

A study of algebraic and transcendental curves, from the analytical and graphical point of view. First semester. Two units.

8. Computation. ASSOCIATE PROFESSOR MARSHALL

In this course will be given opportunity for the student to become familiar with many of the empirical and theoretical formulae of engineering, mathematics, and physics. Second semester. Two units.

11. Analytic Geometry of Space.

ASSOCIATE PROFESSOR MEDCRAFT

Fundamental formulae and a brief study of surfaces, curves, and equations. Prerequisite, Mathematics 2. Two hours. First semester. Two units.

## MECHANIC ARTS

PROFESSOR HENLEY, MR. KING, MR. HENDRY

1. Engineering Drawing. MR. KING

Elements of mechanical drawing, including lettering, tracing, and blue printing. Making and reading of working drawings. Commercial drafting room practice. Required of all engineering students. Two three-hour drafting room periods. First semester. Two units. Drawing fee \$1.00.

## 2. Descriptive Geometry.

MR. KING

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids. Required of all engineering students. Prerequisite M. A. 1 or equivalent. One one-hour recitation period and two three-hour drafting room periods. Second semester. Three units.

## 3. Pattern Shop and Foundry.

MR. HENDRY

Bench and machine work in wood; elements of pattern and foundry work. Three three-hour shop periods. First semester. Three units. Laboratory fee \$4.50.

## 4. Forge and Machine Shop.

MR. HENDRY

Forge work in iron and steel; tempering, case hardening and annealing; characteristics of iron and steel; elementary machine shop processes. Three three-hour shop periods. Second semester. Three units. Laboratory fee \$4.50.

## 5, 6. Machine Shop.

MR. HENDRY

Machine shop practical erection and care of machinery; machine tool, bench, and floor work; modern industrial practice. Two three-hour shop periods. Both semesters. Two units, each semester. Laboratory fee \$3, each semester.

## 8. Carpentry.

MR. HENDRY

Wood work including care of tools, framing, jointing, etc. Two three-hour shop periods. Second semester. Two units. Laboratory fee \$3.00.

## 9. Forge and Metals.

MR. HENDRY

Forge work in iron and steel, pipe work, drill press, care of small machinery. Two three-hour shop periods. First semester. Two units. Laboratory fee \$3.00.

## 10. Mechanical Drawing.

MR. KING

A general elementary course for non-engineering students. Two three-hour drafting room periods. Second semester. Two units. Drawing fee \$1.00.

## 11, 12. Free Hand Drawing and Lettering.

MR. KING

An elementary course for students in general science and liberal arts. Two three-hour drawing room periods. Either semester. Two units, each semester.

**MECHANICAL ENGINEERING**

PROFESSOR HENLEY, MR. KING

**1. Mechanisms.**

MR. KING

Theory and design of linkages, gears, cams, screws, and other machine elements. A study of the relative motions of machine parts. Graphical methods are followed throughout. Required of students in mechanical and electrical engineering. One one-hour lecture period, and two three-hour drafting room periods. First semester. Three units. Drawing fee \$1.00.

**2. Machine Drawing and Empirical Design.**

MR. KING

This course treats of the elements of machine design, taking up such subjects as shafts, bearings and lubrication, pulleys, belts, clutches, standard machine parts, fastenings, etc. Required of students in mechanical and electrical engineering. One one-hour lecture period and two three-hour drafting room periods. Second semester. Three units.

**3. Heat Engines.**

PROFESSOR HENLEY

An elementary course in the theory of steam and other heat engines. Problems in application of thermodynamic theories. Laboratory work in use of the indicator, and other experimental apparatus. Required of students in mechanical, electrical, and civil engineering. Two one-hour lecture periods and one three-hour laboratory period. Second semester. Three units. Laboratory fee \$3.00.

**4. Pumping Machinery.**

PROFESSOR HENLEY

A study of pumps, compressors, vacuum pumps, blowers, exhausters, etc. Problems in performances and efficiencies, and in selection of equipment for specific purposes. Two one-hour lecture periods and one three-hour laboratory period. First semester. Three units. Laboratory fee \$3.00.

**5, 6. Machine Design.**

MR. KING

Design of machinery and machine parts. Consideration of conditions of construction and operation. Proportioning of parts for strength and efficiency. Required of students in mechanical and electrical engineering. (Electrical engineering students take course 15 instead of course 6 in the second semester.) One one-hour lecture period and two three-hour drafting room periods. Both semesters. Three units, each semester. Drawing fee \$1.00.

## 7, 8. Mechanical Laboratory.

PROFESSOR HENLEY

Testing different types of engines, boilers, pumps, injectors, and other apparatus. Investigation of problems arising in the design, selection, or operation of machinery. Reports of tests, inspections, etc. Required of students in mechanical and electrical engineering. (Electrical engineering students omit one laboratory period.) One one-hour lecture period and two three-hour laboratory periods. Both semesters. Three units, each semester. Laboratory fee \$6.00.

## 9, 10. Engine Design.

PROFESSOR HENLEY

Design of the main features of a steam or gas engine, pump or compressor, with the completion of as many of the working details as the time permits. Required of students in mechanical engineering. Two three-hour drafting room periods. Both semesters. Two units, each semester. Drawing fee \$1.00.

## 11. Advanced Heat Engines.

PROFESSOR HENLEY

A continuation of course 3, taking up present day tendencies in the development of steam engines and boilers, steam turbines, internal combustion motors, etc. Required of students in mechanical engineering. Two one-hour lecture periods. First semester. Two units.

## 12. Power Plants.

PROFESSOR HENLEY

The economic design and operation of power and pumping plants. Problems involving the selection of equipment to perform a given duty with a probable minimum expense. Required of students in mechanical engineering. Two one-hour lecture periods. Second semester. Two units.

## 13. Senior Seminar.

Required of fourth year students in mechanical engineering. One one-hour conference period. First semester. One unit.

## 14. Small Power Plants and Pumping Machinery.

PROFESSOR HENLEY

An abridged course in small machinery installations and problems encountered with the ordinary small pumping plants. Two one-hour lecture periods and one three-hour laboratory or field period. First semester. Three units. Laboratory fee \$3.00.

## 15. Mechanical Design of Electrical Machinery. MR. KING

A continuation of course 5, paying particular attention to the special problems involved in the design of motors, generators, and other electrical machinery. Required of students in electrical engineering. Two three-hour drafting room periods. Second semester. Two units.

## 16. Junior Seminar.

Required of third year students in mechanical and electrical engineering. One one-hour conference period. Second semester. One unit.

## METALLURGY

ASSISTANT PROFESSOR WILLIS

## 2. Fire Assaying.

The theory of assaying is developed in this course. Special attention is given to the constitution of the ore and necessary fluxes, with the aim of making the student thoroughly familiar with the principles involved. Special attention is directed toward making this course as practical as possible. Although the importance of accurate work is at no time lost sight of, constant efforts are made to enable the student to handle a large amount of work in as short a time as possible. Required of all students in mining engineering. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$15.

## 11. General Metallurgy and Metallurgy of Copper and Lead.

The theory and practice of metallurgy, fuels, refractories, metallurgical processes and furnaces. Metallurgy of copper includes roasting, blast furnace matte smelting, pyritic smelting and reverberatory matte smelting. Smelting of oxidized copper ores to pig copper. Smelting and refining of native copper ores, copper converting, and hydro-metallurgy of copper. Metallurgy of lead, smelting of ores for lead only, blast furnace smelting with lead as a collector, calculation of charges, desilverization processes, furnace products and their treatment. Required of all students taking mining engineering. Two one-hour lectures. First semester. Two units. One three-hour laboratory period. First semester. One unit. Laboratory fee \$5.

## 11a. Metallurgical Laboratory Practice.

Laboratory practice running parallel to Metallurgy 10, including experiments in roasting, sintering, lead refining, electrolytic copper refining, furnace tests, and leaching methods for the extraction of



copper. Required of all students taking metallurgical option of mining engineering course. Three three-hour laboratory periods. First semester. Three units. Laboratory fee \$10.

#### 12. Metallurgy of Iron, Steel, and Alloys.

This course covers the blast furnace production of pig iron, ores of iron, blast furnace and accessories, blast furnace reactions, calculation of furnace charges, production of pig iron, manufacture of steel and rod iron, and the manufacture of bronzes, brasses, and other alloys. Required of all students taking mining engineering. Two one-hour lectures. Second semester. Two units.

#### 14. Metallurgy of Gold and Silver.

This course includes the theory and practice of stamp milling, chlorination, and amalgamation. Cyaniding is taken up in considerable detail, with laboratory practice and testing for cyanide processes. Required of all students taking the mining and metallurgical option of mining engineering. One one-hour lecture. Second semester. One unit. Three three-hour laboratory periods. Second semester. Three units. Laboratory fee \$10.

#### 6. Metallurgical Laboratory Thesis Work.

Original problems in the treatment of ores, experiments to determine the best method of treatment. This work is only given in the fifth year.

#### 8. Metallurgy of Rare Metals.

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, and molybdenum. Open only to students taking post-graduate work. Two one-hour lectures. Second semester. Two units.

#### 10. Smelter Design.

A practical metallurgical problem such as may confront the student on entering the practical field. Open only to graduate students. Three hours or an equivalent. Second semester. Three units.

#### 13. Advanced Metallurgy.

For graduate students in metallurgy, designed for those who wish to work on one of the problems afforded by the complex ores of Arizona. The work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

## MILITARY SCIENCE AND TACTICS

PROFESSORS BROWN AND MESERVE, MESSRS. BREWER AND CULIN

### 1, 2, 3, 4. Military Tactics: Drill.

This work is required of all male students throughout four semesters of college work. The work consists of drill for three periods a week, one hour each, for the time above indicated. Three hours. Both semesters. One unit, each semester.

### 9, 10. Military Tactics: Theory.

The work consists of recitations, once a week, for two semesters, and covers the school of the soldier; the school of the squad; school of the battalion; close and extended order; ceremonies; battle exercises; and target practice, bayonet exercise, and fencing. Text-books: U. S. Drill Regulations, Manual of Guard Duty, Outlines of First Aid for the Hospital Corps, Manual of Small Arms Firing Regulations, and Manual of Bayonet Exercise and Fencing. One hour. Both semesters. One unit, each semester.

### 5, 6, 7, 8. Military Science.

Each course is pursued for one semester, two hours a week, and the ground covered by all four courses, in four semesters, includes elementary law, elementary international law, military law, ordnance and gunnery, military engineering, the art of war, battles and campaigns. Two hours. Both semesters. Two units, each semester.

## MINERALOGY

PROFESSOR GUILD

### 1. Determinative Mineralogy and Blow-Pipe Analysis.

PROFESSOR GUILD AND MR. MINISTER

Laboratory work with occasional recitations. Text-book: Lewis, *Determinative Mineralogy*. Prerequisite, Chemistry 2. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$12.

### 3. Elementary Crystallography. Prerequisite, Physics 2.

Two lectures or recitations. One or two units.

### 4. Descriptive Mineralogy.

Lectures and recitations on the paragenesis, use, and classification of minerals. Study of a large number of hand specimens of minerals.

Text-book: Kraus, *Descriptive Mineralogy*. Prerequisites, Geology 1, Mineralogy 1 and 3. Three lectures. Second semester. Three units.

#### 5. Optical Mineralogy.

The microscopic study of the rock-forming minerals. Prerequisites, Geology 2 and Mineralogy 4. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$2.50.

#### 6. Petrography.

Preparations of thin sections of rocks for microscopic study, and study of a type selection of rocks. Prerequisite, Mineralogy 5. Two three-hour laboratory periods. Second semester. Two units. Laboratory fee \$2.50.

#### 7. Crystallography.

Measurement, projection, and drawing of crystals. Prerequisite, Mineralogy 3. Six or twelve hours laboratory work. Either semester. Two or four units. Laboratory fee \$2.50.

## MINING ENGINEERING

ASSISTANT PROFESSOR WILLIS

#### 10. Principles of Mining.

This course is introductory to all succeeding mining courses. Topics discussed are, the history and importance of the mining industry and its influence on the settlement and civilization of the world, practical methods of field prospecting, and methods of excavation. Methods of quarrying, placer mining, open cut mining, coal mining are taken up in some detail. Required of all students taking mining engineering. Three one-hour lectures. First semester. Three units.

#### 11. Ore Dressing.

A study of the theory and practice of concentration problems, determination of the laws of classification and jigging, laboratory testing of ores for the determination of processes, operation and adjustment of commercial sizes of ore dressing machinery, and testing of commercial machines. Required of all students taking mining engineering. Two one-hour lectures. First semester. Two units. One three-hour laboratory period. First semester. One unit. Laboratory fee \$3.

## 12. Ore Dressing Laboratory.

A research problem to determine a method of economical extraction by concentration and the making of a flow sheet. Required of all students taking mining or metallurgical options in mining engineering course. Three three-hour laboratory periods. Second semester. Three units. Laboratory fee \$5.

## 13. Mining Machinery.

Machinery in its application to mining, taking up in detail churn and diamond drills, hand and machine tools for excavation, air compression, rock drills, electric drills, tunneling machines, hydraulicking machinery, coal mining machinery, methods of haulage including aerial tramways and hoisting machinery, drainage and pumping machinery, ventilation and illumination. Surface plants, including shops, ore bins, head frames, rock houses and breakers. Required of all students taking mining or metallurgical options in the mining engineering course. Two one-hour lectures. First semester. Two units.

## 14. Methods of Mining.

This course deals with the ways of blocking out underground ore bodies, the correct interval between levels, the different methods of stoping, with the range of application, the different kinds of ore bodies, and to flat or steeply pitching veins, the advantages and disadvantages of underhand stopes, overhand rill-cut, and shrinkage stopes. A careful consideration of complete systems of development and mining, such as transverse, shrinkage stopes, pillars, square set stopes, top slicing, back caving, and the various methods of filling and flushing. This work is further illumined by the solution of many problems taken from practice and the devising of methods of operating. Required of all students taking mining engineering. Two one-hour lectures. Second semester. Two units.

### 14a. Mining Laboratory.

Practical underground mining, use and care of underground machinery, methods of mining, shaft sinking, tunneling, handling of explosives, timbering methods, steel sharpening, and the varied other problems of actual underground operation. Required of all students taking mining option in mining engineering course. Three three-hour laboratory periods. Second semester. Three units. Laboratory fee \$10.

5, 6, or Social Science 21, 22. Principles and Economics of Mining.

PROFESSORS WILLIS AND CHANDLER

A detailed study of the business of mining. Mine examinations, sampling, reports, valuation of mines, considerations preceding the opening of mines, organization, incorporation, financing, mine promotion, stockholders' rights, mining investment, frauds, mine administration, leasing, ore contracts, costs of operations, cost accounting with reference to mines especially, analysis of costs, administrative reports, statistics, royalties, influence of transportation facilities, development of mines, factors governing methods, underground methods, safety costs, mechanical equipment, efficiency, power conditions, surface handling, ore sorting, freight contracts, smelter contracts, labor problems, systems of handling, labor unions, mine accidents, laws regulating social condition of workmen, mining law of United States and Arizona. Three hours. Both semesters. Three units, each semester.

#### 7. Practical Mining.

Before entering upon the work of the Senior year, all students who are candidates for the degree of B. S. in Mining Engineering and Metallurgy, must have spent at least six weeks in practical underground mining or in practical metallurgical work. The fulfillment of this requirement must be evidenced by the certificate of the superintendent or foreman, by notes and sketches of the processes observed, and a report of such work, to be made before November 1st of the same year.

#### 15. Mill Design.

The solution of problems in design and construction of concentration and reduction works, with working drawings, bills of material, specifications and estimates. Open to graduate students only. One one-hour lecture period. Two three-hour laboratory periods. Three units.

#### 16. Mining Engineering Thesis Work.

Special problems and investigations in mining methods, mining machinery, equipment and design, and ore dressing. Open to graduate students only.

#### 17. Advance Mining Engineering.

For graduate students in mining engineering, especially for those who wish to work on one of the varied problems afforded by the



mining districts of Arizona. All work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

#### 18. Advanced Ore Dressing.

For graduate students in mining engineering, designed for those who wish to work on one of the problems of concentration afforded by the various ores of Arizona. Work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

NOTE. All students in mining engineering in the Senior year are required to give one hour a week in seminar for the discussion of current technical literature in mining, for which work no credit is given.

#### Field Excursions.

In connection with the courses in Mining Engineering and Metallurgy, trips are made to mining districts in Arizona and Sonora, usually one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering and Metallurgy.

These trips afford the student close study and inspection of mining and metallurgical plants, of rock formations, and of minerals of commercial value. The students are accompanied by members of the faculty, and effort is made to make the trips of the greatest practical value. The trips are carefully scheduled; notes, with sketches, measurements and photographs, are taken, and are elaborated into comprehensive reports by each student after the return.

During April, 1915, the mining districts and reduction plants of Globe, Miami, and Ray were visited in this way. The 1916 trip will be to Bisbee, Douglas, Tombstone, and Cananea.

#### SHORT COURSE IN MINING

The University of Arizona offers short courses extending over a period of the entire year, combining both laboratory and lecture instruction in mining, metallurgy, geology, and allied subjects. These courses are designed primarily for men who are unable to take regular courses at the University, and are for the purpose of giving that especial knowledge that will improve a man's work and be of assistance to him in obtaining and satisfactorily filling higher positions in the mines and mills of the state. The work is designed for mature students. Further details are supplied in a separate pamphlet, which may be had upon application to the President of the University.

## MUSIC

PROFESSOR —————

The Department of Music offers an opportunity for all University students to secure regular courses in piano, voice, stringed and wind instruments.

The courses in the history and theory of music as enumerated below may be taken as electives to count toward a degree.

## 1. History of Music.

A general survey of the development of music; primitive music, music of ancient civilization, church music, choral music, oratorio, and opera; the evolution of instruments and instrumental forms; the study of great master composers and their relation to the musical movements of the time. Two hours. First semester. Two units.

## 2. History of Music.

A continuation of Music 1. Two hours. Second semester. Two units.

## PHILOSOPHY AND PSYCHOLOGY

PROFESSOR VON KLEINSMID

## 1. Introduction to Philosophy.

A preliminary study of the field of philosophical discussion, pointing out its chief problems and proposing methods for their investigation. The aim of the course is to train in independent reflection and to make the student acquainted with philosophical method and material. Not open to Freshmen. Two hours. First semester. Two units.

## 2. Logic.

An elementary course in the theory of reasoning, including a study of the essentials of logic and training in the detection of fallacies. Not open to Freshmen. Two hours. Second semester. Two units.

## 3. History of Ancient and Mediaeval Philosophy.

A study of the development of speculative thought to the beginning of the modern period, together with a consideration of its relation to practical life. Open to Juniors and Seniors who have had course 1. Three hours. First semester. Three units.

#### 4. History of Modern Philosophy.

A study of the problems of Philosophy from the time of the Renaissance to the present day. A continuation of course 3. Three hours. Second semester. Three units.

#### 5. Ethics.

A study of the essential nature and the growth of morality with the application of moral theory to psychological, social, and economic problems of the present day. Open to those who have had course 1. Offered in 1915-16 but not in 1916-17. Three hours. First semester. Three units.

#### 6. Present Philosophical Tendencies.

A consideration of contemporary thought, designed to give acquaintance with current philosophical problems and discussions. Open to those who have had courses 3 and 4. Offered in 1915-16 but not in 1916-17. Two hours. Second semester. Two units.

#### 7. Philosophy of Religion.

A philosophical interpretation of the nature of religious consciousness, together with a survey of the history of religions. Open to those who have had course 1 and course 9. Not offered in 1915-16 but offered in 1916-17. Three hours. First semester. Three units.

#### 8. Philosophy of Religion.

A continuation of course 7. Three hours. Second semester. Three units.

#### 9. General Psychology.

A study of sensation, imagination, perception, attention, higher intellectual processes, and the affective life. This course is prerequisite to all other courses in Psychology and is designed as well for students satisfying the requirements of other departments. Not open to Freshmen. Three hours. First semester. Three units.

#### 10. Advanced General Psychology.

A continuation of course 9 but a more intensive study of the general phases of Psychology. Open to those who have had course 9. Three hours. Second semester. Three units.

#### 11. Child Psychology.

A study of the genesis of mental states as they appear in the evolutionary series, with special attention to the Psychology of Childhood.

Should be preceded by a course in Biology. Open to those who have had course 1. Three hours. First semester. Three units.

12. Psychology of Adolescence.

A consideration of the various aspects of adolescence, emphasizing those phases of greatest importance to parents and teachers. Open to those who have had course 1. Three hours. Second semester. Three units.

13. Experimental Psychology.

An attempt to familiarize the student with psychological apparatus, methods of procedure, and results, providing for an intimate study of normal mental phenomena. Should be taken by all who purpose to do special work in Psychology. Open to Seniors who have had course 1. Offered in 1915-16 but not in 1916-17. Two hours. First semester. Two units.

14. Experimental Psychology.

A continuation of course 13. Two hours. Second semester. Two units.

15. Abnormal Psychology.

A consideration of psychopathology as observed in various abnormalities. A study of mentally exceptional children, the criminal mind and insanity, together with a brief investigation of the occult. Open to Seniors who have had course 1. Three hours. First semester. Three units.

16. Abnormal Psychology.

A continuation of course 15. Three hours. Second semester. Three units.

17. Clinical Psychology.

A study of the methods of clinical examination, tests, scales of measurement, types, and classification. Open only to those advanced students who have the permission of the professor in charge. Not offered in 1915-16 but offered in 1916-17. Two hours. First semester. Two units.

18. Clinical Psychology.

A continuation of course 17. Two hours. Second semester. Two units.

## PHYSICS

PROFESSOR DOUGLASS

## 1, 2. General Physics.

Lectures, recitations, and laboratory work. First semester: Mechanics, sound, and heat. Second semester: Electricity and light. The laboratory experiments give prominence to mechanics, electricity, and light but include the study of wave motions and their application to other subjects. Prerequisites, Elementary Physics and Mathematics 1. Those who have not had elementary physics will be required to take an extra unit of work without credit, consisting of the recitation and lecture work of Physics 21, 22. Required in all engineering courses. Two hours and two two-hour laboratory periods. Both semesters. Four units, each semester. Laboratory fee \$1.

## 3. Thermodynamics and Heat.

The foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. One hour and two three-hour periods. First semester. Three units.

## 4. Electrical and Optical Measurements.

Electrical machines and instruments used in mechanical engineering, and optical instruments handled in mining and civil engineering courses. Prescribed for the third year in civil engineering courses. One hour and two three-hour periods. Second semester. Three units.

## 5. Mechanics and Sound Measurements.

Calculation and measurement of forces, laws of falling bodies, mechanics of rotation. Simple harmonic motion and wave motion. One hour and two three-hour laboratory periods. First semester. Three units.

## 6. Optical Measurements.

Continuation of course 4, spectroscopy and polarization. Two three-hour laboratory periods. Second semester. Two units.

## 8. Electrical Measurements.

Continuation of course 4, potentiometer, thermo-electricity and low resistance measures. Two three-hour laboratory periods. Second semester. Two units.



## 21, 22. Descriptive Physics.

Historical and descriptive consideration of Physics principles, with practice in handling and reading various measuring instruments. This course cannot be taken for credit by students who have had preparatory physics. Two hours and one three-hour laboratory period. Both semesters. Three units, each semester.

## PHYSICAL TRAINING

Opportunities for gymnasium work are open to men, but physical training is required for women only.

1, 2. Physical Training. MISS CHAPIN

Required of all first year students. Elementary Swedish gymnastics, breathing exercises, simple folk-dances,—emphasis constantly on improvement in standing and walking. Three hours. One unit.

3, 4. Physical Training. MISS CHAPIN

Prerequisite, Physical Training 1, 2, A course in dancing. Exercise to develop coordination of arms with the other muscles of the body. Constant exercises in breathing. The study of typical dances of various nations, and an attempt to make the student use the dance as a fine form of exercise for all the muscles of the body, as well as a delightful form of expression. Three hours. One unit.

5. Physical Training. MISS CHAPIN

No prerequisite. All young women in the University may attend. A recreation course, consisting first, of simple Swedish movements of easy folk-dances,—and then, some of the best social dances of ancient and modern times. An effort is made to develop an intelligent attitude toward dancing, and to improve the standards of social dancing by comparing the dances of various centuries, and analyzing the elements which make them desirable, enjoyable, and beautiful types of diversion. One hour.

## ATHLETICS

The climate of Tucson permits out of door athletics throughout the academic year. The main out of door sports are football, baseball, tennis, and track work. Basketball is played indoors. Every student is encouraged to undertake some form of athletics. Tennis is played during the entire year.

The percentage of students engaged in athletics is unusually large. Team work is provided to add interest to sports. Competitive ath-

letics are pursued with the schools, colleges, and universities of Arizona, New Mexico, and Southern California.

An interscholastic meet is held in April for all the high schools and academies of the State.

## ROMANCE LANGUAGES

PROFESSOR TURRELL, MISS POST

### FRENCH

#### 1, 2. Elementary French. PROFESSOR TURRELL AND MISS POST

First semester: Fraser and Squair, *French Grammar*, (Part I); Aldrich and Foster, *French Reader*. Second semester: Labiche and Martin, *La Poudre aux Yeux*; Halévy, *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs. Five hours. Both semesters. Four units, each semester.

#### 3, 4. Advanced French. PROFESSOR TURRELL AND MISS POST

First semester: Fraser and Squair, *French Grammar*, (Part II); Merimée, *Colomba* or *Carmen*; Lamartine, *Grazielle*; Sand, *La Mare au Diable*. Second semester: Victor Hugo, *Les Misérables*, (abridged); Balzac, *Eugénie Grandet*; Zola, *La Débacle*, etc. Composition and conversation, using Talbot's *Le Français et sa Patrie*. Five hours. Both semesters. Four units, each semester.

#### 3a, 4a. Advanced French. (For students entering with two years of high school French.)

PROFESSOR TURRELL AND MISS POST

Grammar, composition, etc., as in French 3; reading as in French 4. Three hours. Both semesters. Two units, each semester.

#### 5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists: plays of Corneille, Racine and Molière. Lectures on the eighteenth century: Voltaire, Rousseau, Diderot, etc. Beaumarchais, *Le Barbier de Seville*. Library readings. Prerequisite, French 3, 4, or 3a, 4a. Three hours. First semester. Three units.

#### 6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier. Recent literary movements in France.

Pailleron, Dumas, Rostand, Zola, Sardou, Maeterlinck, etc. Prerequisite, French 5. Three hours. Second semester. Three units.

7, 8. Advanced Composition and Conversation.

PROFESSOR TURRELL

Weill, *French Newspaper Reader* and Kron, *French Daily Life* will be used as a basis for conversation. Composition and essays. Prerequisite, French 3, 4, or 3a, 4a, and 5, 6, or may be taken with 5, 6. Two hours. Both semesters. Two units, each semester.

9, 10. Nineteenth Century Prose.

PROFESSOR TURRELL

Study of the development of the French novel in the Nineteenth Century. Reading of works of Hugo, Balzac, Dumas, Flaubert, Zola, Daudet, Bazin, Loti, France, Rolland, etc. Prerequisite, 5, 6, or may be taken with 5, 6. Two hours. Both semesters. Two units, each semester.

## SPANISH

1, 2. Elementary Spanish.

MISS POST

First semester: Coester, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Second semester: Grammar and Reader completed; Alarcón, *El Capitán Veneno*. Conversation and dictation throughout the year. Five hours. Both semesters. Four units, each semester.

3, 4. Advanced Spanish.

MISS POST

First semester: Galdós, *Marianela*; Valdés, *La Hermana San Sulpicio*. Second semester: Valera, *Pepita Jiménez*; Blasco-Ibañez, *La Barraca*, etc. Composition, letter writing, and conversation throughout the year, using Crawford, *Spanish Composition*. Five hours. Both semesters. Four units, each semester.

3a, 4a. Advanced Spanish. (For students entering with two years of high school Spanish.)

MISS POST

Composition, conversation, etc., as in Spanish 3, 4. Three hours. Both semesters. Two units, each semester.

5. Spanish Literature to the Nineteenth Century.

PROFESSOR TURRELL

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don*

*Quijote*, (Selections); Lope de Vega, *La Moza de Cántaro*; Calderón, *La Vida es Sueño*," etc. Prerequisites, Spanish 3, 4 or 3a, 4a. Three hours. First semester. Three units.

6. Spanish Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. Reading of Mortaín, *El Sí de las Niñas*; Gutiérrez, *El Trovador*; Nuñez de Arce, *El Haz de Leña*; Echegaray, *El Gran Galeoto*; Galdós, *Electra*; Benavente, *Los Intereses Creados*, etc. Prerequisite, Spanish 3, 4 or 3a, 4a. Three hours. Second semester. Three units.

7, 8. The Literature of Mexico.

PROFESSOR TURRELL

A survey of the literary history of Mexico. Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc. Prerequisite, Spanish 5, 6. Two hours. Both semesters. Two units, each semester.

9, 10. Advanced Composition and Commercial Spanish.

PROFESSOR TURRELL

A practical course in writing and speaking Spanish. Remy, *Spanish Composition*; Harrison, *Commercial Spanish Reader*, and Harrison, *Spanish Correspondence* will be used. Prerequisite, Spanish 3, 4, or 3a, 4a, and for A. B. students, 5, 6. Two hours. Both semesters. Two units, each semester.

11, 12. Scientific Spanish. (For Technical and Engineering students.)

PROFESSOR TURRELL

Willcox, *Scientific and Technical Spanish*. Study of vocabulary of electricity, steam engines, mining, bridge building, etc. *Boletín de la Unión Panamericana* and supplementary readings. Prerequisite, Spanish 3, 4, or 3a, 4a, or may be taken with these courses. Also at least one year each of physics and chemistry. Two hours. Both semesters. Two units, each semester.

### PEDAGOGICAL

Romance Languages 1. Methods of Teaching French.

PROFESSOR TURRELL

Study and comparison of various grammars and texts, with particular reference to the needs of high schools and to college entrance requirements. Prerequisite, French 5, 6, 7, 8, or an equivalent. One hour. First semester. One unit.

## Romance Languages 2. Methods of Teaching Spanish.

PROFESSOR TURRELL

Similar to course 1, but emphasizing Spanish, and particularly the adaptation of various methods to the teaching of the language in Arizona and the Southwest. Prerequisite, Spanish 5, 6, 9, 10, or an equivalent. One hour. Second semester. One unit.

## EVENING COURSES

## Spanish 1a, 2a. Elementary Spanish.

Miss Post

Covering the work of Spanish 1. (First semester of first year.), emphasizing as far as possible conversation and oral work. May not be taken by regular students as a substitute for Spanish 1, except by special permission. Tuesday and Thursday evenings at 7:30. Two hours. Both semesters. Two units, each semester.

## Romance Languages 3, 4. Contemporary Drama.

PROFESSOR TURRELL

Discussion in English of contemporary French and Spanish drama; selections from the plays of writers such as Maeterlinck, Rostand, Bernstein, Brieux, Flers and Caillavet, Kistermaecker, etc., in French, and Galdós, Benavente, Martinez Sierra, the Quinteros, Marquina, etc., in Spanish. Knowledge of French or Spanish is not necessary, but will be helpful. The aim will be to acquaint those interested in the drama with the best work that is being done in France and Spain at the present time. Open to all students and to the public. Wednesday evening at 7:30. One hour. Both semesters. One unit, each semester.

## SOCIAL SCIENCE

PROFESSOR CHANDLER AND ASSISTANT PROFESSOR HUBBARD

## 1, 2. Introduction to Economics.

PROFESSOR CHANDLER

The general principles underlying the science, with emphasis upon practical application, in business, industry, and the home. The elements of fundamental lines of business activity that are important to all who have to earn a living or manage a home, including: markets and buying; prices; insurance; taxation; credits; transportation; elements of cost; principles of labor efficiency. Because of local importance much attention is given to the application of economic principles to mining and agriculture. Open to all students. Three hours. Both semesters. Three units, each semester.



## 3. Industrial and Commercial Organization.

PROFESSORS CHANDLER AND HUBBARD

The scientific basis of large scale industry through analysis of principles of competition, combination, monopoly and the savings of integration; various business units from the point of view of comparative efficiency for different kinds of business; methods of business consolidation; scientific management and elements of cost. Materials of commerce and commercial geography with reference to foreign trade and competition. The tariff system and trust problems. Prerequisite, Social Science 1, 2. Offered in 1914-15 and alternate years. Four hours. First semester. Four units.

## 4. Transportation and Commerce.

ASSISTANT PROFESSOR HUBBARD

The materials of commerce, American commercial geography, raw products and other material sources of American business and transportation. Rise of the American railway system; its past and present relation to the development of agriculture, mining, manufacturing, and other industries. Relation of the railroad to the government and the public; rights of the shipper; railway rates. Open to those who have had Social Science 1, 2. Offered in 1914-15 and alternate years. Four hours. Second semester. Four units.

## 5. Corporation Organization and Finance.

PROFESSOR CHANDLER

Organization and management; how and where to organize; powers and privileges of corporations in the different states; minority rights. Business development and promotion of various properties and enterprises, with special reference to the promotion and development of mining companies. Offered in 1915-16 and alternate years. Three hours. First semester. Three units.

## 5a. Financial Institutions and Investments.

PROFESSOR CHANDLER

A study of the investment market, including: Financial agents and institutions; stock exchanges; stock market; investments of securities; methods and laws of investment and speculation; relative merits of railway stocks, bonds, municipal bonds, industrial, irrigation, and mining securities. Offered in 1915-16 and alternate years. Three hours. Second semester. Three units.

## 7. Sociology and Social Reform. PROFESSOR CHANDLER

An introduction to the study of society and social problems, including: principles of social evolution; the social function of the home and the family; the problem of the dependent; the defective, and the delinquent; modern methods of social service and scientific social reform. Open to all students. Three hours. First semester. Three units.

## 8. American Politics. PROFESSOR CHANDLER

Underlying principles and practical methods of federal, state, and municipal government and politics; platforms and organization of political parties; modern methods of expert government and administration; legislative reference work, and bureaus of public efficiency. Three hours. Second semester. Three units.

## 9. Labor Problems. PROFESSOR CHANDLER

Origin of the labor problem and history and growth of labor organizations. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of living of American workmen; sweating system; poverty and unemployment. Organized labor vs. organized capital; strikes and lock-outs; closed vs. the open shop; collective bargaining; employers' organizations. Political and legal aspects; use and abuse of the injunction; police power of the state; the laborer in politics. Offered in 1915-16 and alternate years. Three hours. First semester. Three units.

## 10. Economic Reform Movements. PROFESSOR CHANDLER

This course logically follows Social Science 9. The labor question with emphasis upon the constructive side; the chief proposals for the solution in America, Europe, and Australia; profit sharing; co-operation; industrial education; compulsory arbitration; labor legislation in the United States. Offered in 1915-16 and alternate years. Three hours. Second semester. Three units.

## 12a, 12b. Seminar in Arizona Problems. PROFESSOR CHANDLER

Open only to advanced students. One to three hours. Both semesters.

## 13, 14. Elementary Accounting. ASSISTANT PROFESSOR HUBBARD

An introductory study of simple accounts; the general principles of accounting, meaning of the balance sheet and other reports furnished

by firms and corporations, and accounting problems incident to efficient business management. Concrete examples, with special attention to farm, engineering, and cost accounting. Open to all college students. Two hours. Both semesters. Two units, each semester.

15. Advanced Accounting. ASSISTANT PROFESSOR HUBBARD

Offered in 1914-15 and in alternate years. Two hours. First semester. Two units.

16. Municipal Problems and Public Finance.

PROFESSOR CHANDLER

The city in its economic, political, and social aspects. Open to those who have had Social Science 1, 2, 7, 8. Offered in 1914-15 and alternate years. Three hours. First semester. Three units.

18. Agricultural Economics. ASSISTANT PROFESSOR HUBBARD

Business aspects of rural life; capital and labor as applied to farming, irrigation, forestry, and mineral lands; agricultural banking and credit; buying of supplies and marketing of products; the public domain, state and national. Students of agriculture, who have not taken the work in Social Science 13, covering agricultural accounting, will be given in this course a simplified system of farm accounts. Three hours. First or second semester. Three units.

19. Money and Banking. ASSISTANT PROFESSOR HUBBARD

Functions of money and its relation to credit institutions; monetary system of the United States; theory and history of banking; function of the savings bank, the trust company, the clearing house; history of American finance; financial crises in their relation to our present currency and banking systems; examination of the principal banking systems of the world for the purpose of finding ideas which would render the American system more nearly conformable to our growing financial and commercial needs. Open only to Juniors and Seniors who have had at least one year of Social Science. Three hours. First semester. Three units.

21, 22. Principles and Economics of Mining.

PROFESSOR CHANDLER AND PROFESSOR WILLIS

Especially for students of mining engineering, and given jointly with the Department of Mining Engineering. Same as Mining 5, 6. Not open to students who have had Social Science 5 and 5a. Offered in 1914-15 and alternate years. Three hours. Both semesters. Three units, each semester.

## BUSINESS COURSES IN THE UNIVERSITY

The University now offers two courses in Business, Economics, Commerce, and Finance; a two-year course in practical Business Economics leading to a certificate; and a four-year course leading to the degree of Bachelor of Science in Commerce.

The two-year course in Business Economics is offered especially for those high school graduates who wish to prepare for business life and who cannot take a four-year course in commerce. Emphasis is placed upon the more practical phases of business training. Any subject in the two-year course will be accepted for full credit in the four-year course. One of the valuable features of this course consists of talks given by business men to the students. In the past, talks have been given by men who have had experience in business administration, organization, real estate, fire insurance, life insurance, salesmanship, banking, and trust business.

The four-year course in Business Economics, leading to the degree of Bachelor of Science in Commerce, is offered to meet the growing demands of the business world for men who are equipped with technical knowledge of finance, business organization and administration. In addition to all that is given in the two-year course, the student is required to elect science or mathematics, and more foreign language. Entrance requirements are the same as for the degree of Bachelor of Arts.

## SPANISH

(See Romance Languages)

## ZOOLOGY

MR. BROWN

1. Invertebrate Zoology.

Development and anatomy of types of the various phyla of invertebrates. Text: Hegner, *College Zoology*. Two hours of lectures and six hours of laboratory work. First semester. Four units. Laboratory fee \$2.50.

2. Vertebrate Zoology.

A continuation of Zoology 1. Two lectures and six laboratory hours. Second semester. Four units. Laboratory fee \$2.50.

### 3. Histology of the Animal Tissues.

The theory and use of the microscope, the camera lucida, the photo-micrographic camera, the use of chemicals in the preparation of microscope slides. Primarily a laboratory course. Two lectures, six hours laboratory work. First semester. Four units. Laboratory fee \$2.50.

### 4. Physiology.

The blood, respiration, secretion, and absorption. The experiments performed are those used in the first year of physiological work in the medical schools. For college students desiring information regarding the structure and functions of their own bodies, and for those students who are intending to enter a medical school. Two lectures, six laboratory hours. First semester. Four units. Laboratory fee \$2.50.

### 5. Physiology.

A continuation of Zoology 4, so arranged that new students may begin physiology with this course. Study of the circulation and of the nervous system takes the larger part of the semester. Two lectures, six hours of laboratory work. Second semester. Four units. Laboratory fee \$2.50.



## EXTENSION DEPARTMENT

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For two years the University has operated a system of extension lectures under an appropriation made by the legislature. The purpose of the Extension Department is to carry some of the benefits and satisfaction of higher education to a large number of persons who are unable to attend regular courses at the University. This work is carried on through correspondence, by lectures and public discussions, and by the distribution of publications. The University responds to requests for lectures in the various fields of its work, giving these lectures without cost for service to the community. In some cases the community, however, provides transportation and entertainment of the speaker. Schools, clubs, and other organizations desiring speakers for special occasions, for single lectures on some topics, or for a series of lectures, should address correspondence to the office of the President of the University. Ample time should be allowed for the appointment of dates and for the adjustment of all details.

The Extension Department offers its services also to schools, clubs, or other organizations interested in debating and public discussions. Considerable material on all current questions is available and may be secured upon request.

Wherever possible from the facilities at hand, the University will gladly send information either through correspondence to any making specific inquiries concerning matters relating to personal and public welfare, hoping through its large library and its highly trained specialists to place its advantages at the service of all the people of the State.

# AGRICULTURAL EXPERIMENT STATION

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Rufus B. von KleinSmid, Sc. D., President of the University  
Robert H. Forbes, M. S., Director  
John J. Thornber, A. M., Botanist  
Albert E. Vinson, Ph. D., Biochemist  
Clifford N. Catlin, A. M., Assistant Chemist  
George E. P. Smith, C. E., Irrigation Engineer  
Arthur L. Enger, B. S., Assistant Irrigation Engineer  
Alexander M. McOmie, B. S., Assistant Agriculturist  
George F. Freeman, B. S., Plant Breeder  
Johannes C. Th. Uphof, Assistant Plant Breeder  
William H. Lawrence, M. S., Horticulturist  
Stephen B. Johnson, B. S., Assistant Horticulturist  
Richard H. Williams, Ph. D., Animal Husbandman  
Walter S. Cunningham, B. S., Assistant Animal Husbandman  
Austin W. Morrill, Ph. D., Entomologist  
Stanley F. Morse, B. A. S., Superintendent, Extension Department  
George W. Barnes, B. S. A., Farm Advisor, Extension Department  
Leland S. Parke, State Club Agent  
James A. Armstrong, Farm Advisor, Maricopa County  
Arthur L. Paschall, Farm Advisor, Cochise and Santa Cruz  
Counties  
Charles E. Grassick, Secretary  
Helen M. A. Miller, Librarian  
Ruth Murphy, Stenographer  
Eunice Waller, Secretary, Extension Department

## ORGANIZATION AND WORK

The Agricultural Experiment Station is legally appurtenant to the College of Agriculture which in turn is a department of the University organization. The purpose of the Agricultural Experiment Station is to aid "in acquiring and diffusing useful and practical information on subjects connected with agriculture and to promote scientific investigation and experiments respecting the principles and applications of agricultural science."

The activities of the Experiment Station include research and experimentation in Agriculture, Horticulture, Animal Husbandry, Botany, Entomology, Plant Breeding, Chemistry, and Irrigation In-

vestigations, the whole or a major portion of the time of one or more members of the station staff being devoted to each of these lines of station work. Provision is also made for Farmers' Institutes, for a Farmers' Demonstration Train, and for advisory work in Farm Management, by means of which the results of experiments and investigations in agriculture are carried to farmers throughout the State.

Economic farm demonstrations in the production of various crops are carried on from time to time in connection with Experiment Station work; although Farm Management demonstrations and studies are more properly carried out under the provisions of the recently enacted Smith-Lever law, which is now in operation in Arizona.

Owing to wide variations in agricultural conditions in Arizona it has been found of advantage to distribute the various branches of station work with reference to conditions required for its satisfactory accomplishment as follows:

The administrative offices, and the botanical, plant breeding, chemistry and irrigation laboratories are maintained at Tucson in the University buildings. From this base of operations the three great agricultural districts of the State—Salt River Valley, the Lower Colorado Valley, and the Upper Gila district are conveniently accessible for field work and observations.

The main Experiment Station farm has been maintained in Salt River Valley, which is intermediate in elevation and in mean yearly temperature with respect to the irrigated valleys of southern Arizona. Results obtained at this point are therefore capable of general application in the southern part of the State.

The date-palm orchard, conducted in co-operation with the U. S. Department of Agriculture, is situated in the alkaline district at Tempe where successful experimentation with this palm will be of great value in demonstrating a use for extensive areas of alkaline land in the Southwest.

The demonstration farm near Yuma, in the fertile valley of the Colorado River, has also afforded a succession of object lessons to the local public and has contributed information concerning crops, agricultural methods, and markets for this rich region.

Experiments in dry farming have been initiated on a new tract secured for the purpose near Cochise, in Sulphur Spring Valley, in the neighborhood of Snowflake in Navajo County, and near Prescott, Arizona, in localities typical of large areas. The grazing range reserve, also, for the study of worn out range country, with a view to its

reclamation, is conducted in a typical district of intermediate elevation near Tucson, co-operating with the U. S. Department of Agriculture.

The University farm and a plant breeding garden rented of the Evergreen Nursery, afford facilities for botanical and plant breeding studies. Laboratories, greenhouses, and small gardens on the University grounds serve a similar purpose. The results of Experiment Station work are published at intervals in the bulletins and reports of the station. The longer and more technical bulletins and annual reports state in considerable detail the results of investigations as they mature. Timely Hints for Farmers, which are brief, readable writings, are issued at the time when they will be most useful, are written in plain language, and presented in popular form. By means of an extension publicity service organized during the past year still further circulation is given to matters of agricultural interest to the newspapers of the State.

Inasmuch as for years past the mailing list has enabled the station to reach 50 percent or more of the farming population in Arizona, it is not surprising that the effects of station work are now generally in evidence throughout the State, more particularly in our irrigated southern valleys.

The Agricultural Extension service, combining state and federal endowments for agricultural extension work, is effectively carrying agricultural knowledge into practice among Arizona farmers.

Supplementing the federal appropriations and for the purpose of more liberal endowment of agricultural research, education, and extension within Arizona, the first State legislature appropriated \$252,800 for the two years beginning July 1, 1913, as follows:

A new agriculture building at the University.....	\$165,000
Dry farming experiments near Prescott, Snowflake, and in Sulphur Spring Valley.....	18,000
Intensive farming and date-palm studies near Yuma.....	10,000
Horticultural investigations .....	5,000
Underflow water investigations .....	2,500
Plant introduction and breeding.....	4,000
Printing and binding .....	4,500
Farmers' Institutes .....	8,800
Office and library service.....	5,000
160 acres of additional land in Salt River Valley.....	30,000
	<hr/>
	\$252,800

In addition to these items the sum of \$23,500 was appropriated for agricultural instruction at the University for the biennium beginning July 1, 1913.

The Agriculture Building, which will be complete in June, 1915, will offer ample room for research, educational work and extension in agriculture, and will afford an attractive center for the agricultural activities of the State in time to come.

With this endowment and with an organization which brings the agricultural work of the University into close contact with the farming interests of the State, "the farmers' college" has entered upon an epoch of increasing usefulness to the growing agricultural interests of Arizona.



# ARIZONA STATE BUREAU OF MINES

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By act of the legislature of 1915, the Arizona State Bureau of Mines was authorized, the affairs of which are placed under the direction of the Board of Regents of the University of Arizona. The Bureau of Mines is a mining experiment station, to deal with the mining, metallurgical, and geological problems of the State.

The bureau compiles and publishes statistics of all kinds regarding Arizona mines, such as production, values, types of machinery, efficiency reports, methods, mill statistics, and other data of interest and importance to every operator in this State, as well as of other States. A bibliography and library of all literature pertaining to Arizona mining are of obvious utility.

It is aimed to deal experimentally with Arizona problems of wet, dry, and electrostatic concentration, dry placer and flotation methods. Qualitative rock determinations, where the samples sent are given a petrographical or mineralogical name, are made free.

The Bureau of Mines aims to educate the miner and prospector by a series of lectures, articles in daily and weekly mining papers, and publication of items of interest. The employer as well as the miner should profit by this educational work. The bureau will offer to the miner and prospector a place for determining samples; practical advice and instruction and education on the economic side—an office of exchange and information. The same data will be of service to those outside of the state who desire information on Arizona mining.

Assays of ores and minerals are made for prospectors and miners of Arizona and for others at fixed rates established by law and tabulated below. Accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate, and if not accordant, are repeated. The money received for assaying is deposited monthly to the credit of the Assay Fund, which is used to pay the assayer and the cost of material and apparatus.

**RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS**

In accordance with the Act of the Legislature of Arizona, approved March, 1897, and amended in March, 1899.

**COMMON ASSAYS AND CHEMICAL DETERMINATIONS**

One element only:

Gold, or silver, or copper, or, lead, or iron, or insoluble.....	\$ 1.00
Zinc, or calcium, or magnesium, or sulphur, or manganese.....	1.50
Silicon or chlorine .....	2.00
Combinations:	
Gold and silver .....	1.00
Copper and iron, or lead and iron.....	1.50
Insoluble, copper and lead.....	2.00
Insoluble, lead and iron.....	2.00
Insoluble, zinc and iron.....	2.50
Insoluble, lead, copper and iron.....	2.50
Gold, silver, copper and lead.....	2.50
Gold, silver, copper, iron and insoluble.....	2.50

**SPECIAL CHEMICAL DETERMINATIONS**

One element only:

Aluminum, or tungsten, or barium, or chromium.....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorus	4.00
Nickel, or cobalt, or molybdenum, or vanadium.....	5.00

**CHEMICAL ANALYSIS**

Coal and coke analysis, giving moisture, volatile combustion matter, fixed carbon and ash .....	5.00
The same, including determination of sulphur and phosphorus	7.50
Silicate analysis .....	15.00
Cement analysis (chemical) .....	15.00
Cement analysis (mechanical) .....	2.50
Cement tests for strength and soundness by the Department of Civil Engineering .....	10.00

**CONSIGNMENTS AND REMITTANCES**

Samples, ores, and other consignments should be shipped to the Bureau of Mines, Tucson, Arizona. Small quantities may best be sent by parcels post; larger quantities by freight or express.

All assays, chemical determinations and chemical analyses except gratuitous qualitative tests mentioned elsewhere, must be paid for in advance. Remittances should be made by postoffice money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to the University of Arizona.

## DEGREES CONFERRED JUNE 1, 1914

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HORACE MERLE COCHRAN, Master of Science

RYTHA FERDINAND BACKSTEIN, Bachelor of Arts

MAUD MACPHERSON, Bachelor of Arts

FREDERICK WILLIAM ROGERS, Bachelor of Arts

GRACE HELEN WOODDELL, Bachelor of Arts

HERBERT NEAL BRADSTREET, Bachelor of Science in Civil Engineering

RICHARD LOUIS MERRITT, Bachelor of Science in Civil Engineering

ALFRED DOMINGUEZ MICOTTI, Bachelor of Science in Civil Engineering

### HONORS AND PRIZES

#### HONOR SCHOLARSHIPS

Honorary scholarships are conferred annually for the purpose of encouraging scholarship that is sound at every point. They are non-competitive, awarded to every student attaining a required proficiency. Freshmen reaching the required standard of excellence receive honorable mention; Sophomores, Juniors, and Seniors are recognized as Sophomore, Junior, and Senior Scholars respectively; and students carrying the work of both the Junior and Senior years at this standard, are known as the University of Arizona Scholars.

University Scholars: HERBERT N. BRADSTREET, MAUD MACPHERSON

Senior Scholars: HERBERT N. BRADSTREET, MAUD MACPHERSON, RYTHA F. BACKSTEIN

Junior Scholars: PERCY F. MINISTER, FRANK R. ABBOTT

Sophomore Scholars: J. WILSON GETSINGER, MARCUS T. KENDALL, ROSALIND B. BATES, LOIS WHISLER

Honorable Mention in the Freshman Class: ALBERT CRAWFORD, JR., FRED W. FICKETT, MABEL ODELL

Honorable Mention in the Fourth Preparatory Class: MARGARET SMITH

**THE DRACHMAN PRIZES IN DEBATING**

To stimulate interest in public questions, Mr. Harry A. Drachman, of Tucson, offers to the students of the University two annual cash prizes of \$25 and \$15 respectively. During the academic year 1913-1914 the prizes were offered for the two best debates. They were awarded as follows:

First Prize, ROSALIND B. BATES

Second Prize, GRADY GAMMAGE

**THE TROUTMAN MEDALS IN CHEMISTRY**

Dr. George D. Troutman, of Tucson, to stimulate interest among the students in the chemistry of pure foods, has in the past offered two medals, of gold and silver, as prizes for superior work in chemistry. In the year 1913-14 these medals were awarded as follows:

The Gold Medal, PERCY F. MINISTER

The Silver Medal, ALBERT CRAWFORD, JR.

**COUNTY SCHOLARSHIPS**

Leslie V. Clawson, Thatcher, Graham County

Margaret McRoberts, Globe, Gila County

William A. Conley, Douglas, Cochise County

Desmond Christy, Clifton, Greenlee County

Emzy Lynch, Yuma, Yuma County

Francis R. Duffy, Nogales, Santa Cruz County

Charles H. Howard, Prescott, Yavapai County

Jesse Woolf, Glendale, Maricopa County

Donald John, Tucson, Pima County

**BENNETT SCHOLARSHIP**

Mabel Odell

**COLLEGIATE CLUB SCHOLARSHIP**

Gladys V. Gibbs

**STATE FEDERATION OF CLUBS SCHOLARSHIP**

Elsie Windsor

**THE MILITARY PRIZES**

Captain Hiram M. Powell, late Commandant of Cadets, and Mr. Merrill P. Freeman, of Tucson, sometime Regent of the University, have annually presented prizes to the best drilled students,—a saber, the gift of Captain Powell, to the most efficient commissioned officer, and a medal, the gift of Mr. Freeman. Since the death of Captain

Powell the gift of the saber is continued by Mrs. Powell. In the year 1913-14 the requirements for the Freeman medal were increased, the recipient being proficient not only in the military department but also in other work in the University and of high standing in character and conduct.

Colonel George LeRoy Brown, head of the Military Department, offers a medal to the most efficient non-commissioned officer, and another for the best drilled private.

Captain Sidney F. Mashbir, of the National Guard, has offered a gold medal to the cadet making the highest score at long range target practice during the coming year.

In the year 1913-14 these prizes were awarded as follows:

The Freeman Medal, for general scholarship, deportment, and military excellence,

J. WILSON GETSINGER

The Powell Saber, for most efficient commissioned officer,

J. PRESTON JONES

The Brown Medal, for the most efficient non-commissioned officer,

CHARLES Z. LESHER

The Brown Medal, for the best drilled private,

ORVILLE S. MCPHERSON



# MILITARY CORPS ORGANIZATION

Adjutant, Cadet 1st Lieutenant Dudley S. Brown

Quartermaster, Cadet 2nd Lieutenant L. L. Kriegbaum

In charge of Hospital Corps, Cadet 2nd Lieutenant Bert Minor

Ordnance Officer, Cadet 2nd Lieutenant A. C. Jones

Quartermaster Sergeant, Julius C. Pitrat

Color Sergeant, James S. Maffeo

Color Sergeant, John O. Chapman

## COMPANY A

## COMPANY B

## COMPANY C

## COMPANY D

### CAPTAINS

L. F. Cloud      R. G. Lindsley      J. W. Getsinger      F. L. Mack

### FIRST LIEUTENANTS

H. Grimshaw      C. P. Beach      C. W. Clark      F. J. Hobson

### SECOND LIEUTENANTS

C. Z. Leshar      J. A. Hedgpeth      C. E. Scheerer      W. L. Fickett

### FIRST SERGEANTS

W. A. Grabe      O. McPherson      A. Crawford      F. G. McClure

### SERGEANTS

H. H. Mayhew      J. H. Gardiner      H. H. Hield      F. W. Fickett  
H. Harders      M. C. Sexton      F. N. Leavitt      H. Schwalen

### CORPORALS

H. Wood      F. R. Duffy      L. Klein      C. Renaud  
E. F. Russell      K. Hurst      W. Sandige      G. Eberle  
W. L. Jenney      H. Carpenter      W. Carter      G. Peterson  
C. U. Pickrell      J. H. Markham      H. Westover      G. B. Lynch

### BAND

Band Leader—Frederick Dickley

Principal Musicians: Geo. W. Clawson, Alma P. Sessions, Prentice W. Dill

First Sergeant, Ernest Renaud

Sergeant, Carlos Gibson

Drum Major, Wm. L. Jenney

# STATE SCHOOL FOR THE DEAF

The State School for the Deaf is affiliated with the University and under its direction. The school has its own buildings adjacent to the University campus, suitably equipped for the home comfort and the academic and industrial instruction of the children in attendance.

## OBJECT OF THE SCHOOL

It is the object of the school to give children that are too deaf to be educated in the public schools, a liberal education, to restore them, as nearly as possible, to a place in society beside their hearing brothers and sisters, and to equip them in such a way as to render them able to make their own way in the world.

## COURSE OF STUDY

The course of study corresponds to that of the public schools of the State. Any boy or girl who shows the mental capacity, will be given the necessary preparatory work to enter college. At the same time, emphasis is laid on domestic science, carpentry, and gardening. Every girl is taught plain sewing and cooking, and the boys receive instruction in carpentry and gardening.

Teaching speech and lip-reading, occupy a very important place in the work of the school. Every child coming to the school will have the opportunity to be taught to speak and read the lips; finger spelling and manual signs have no place in the method of instruction.

## TERMS OF ENTRANCE

The school is free to children whose parents or guardians are residents of this State. The academic year runs from September 22 to June 1. Parents must furnish necessary clothing and transportation for their children. During the summer recess, all children return to their homes. Application for admission is made to the Superintendent of Public Instruction, Phoenix.

Further information concerning the school will be furnished upon communicating with the Principal.

## OFFICERS AND TEACHERS

Howard Griffin, Principal

Julia Bateman, Teacher

Eleanor Jones, Teacher

Ernest Russell, Instructor in Manual Arts

John R. Sandige, Instructor in Agriculture

Bertha Griffin, Matron

George B. Lynch, Supervisor of Boys

Georgia Bell, Supervisor of Girls

# REGISTER OF STUDENTS

## GRADUATE STUDENTS

Adams, Elizabeth Steele, A. B.....	Tucson
Catlin, Pearle Palmer, A. B.....	Tucson
Drachman, Florence Cowan, A. M.....	Tucson
Estill, Howard S., B. S.....	Tucson
Farra, James A., B. S.....	Lexington, Kentucky
Gianalla, Vincent P., B. S.....	Douglas
Kelton, Frank C., B. S.....	Tucson
McGee, John M., A. M.....	Tucson
Micotti, Alfred D., B. S.....	Tucson
Murphey, Elizabeth, A. B.....	Tucson
Post, Anita Calneh, Ph. B.....	Yuma
Solomon, Hattie Ferrin, B. S.....	Tucson
Strong, Leon Henri, A. B.....	Tucson
Swan, Laura Mae, A. B.....	Tucson
Williams, Jessamine Chapman, B. S.....	Tucson

## SENIORS

Aylworth, Herbert R.....	Tucson
Barkley, Bessie J.....	Tucson
Brewer, Walter M.....	Los Angeles, California
Carter, Mabel R.....	Yuma
Conrad, Agnes.....	Madison, Wisconsin
Culin, Frank L., Jr.....	Tucson
Curry, Esther M.....	Yuma
Duffy, Catherine, G.....	Tucson
Hayhurst, Normal C.....	Tucson
Jackson, Lawrence R.....	Santa Monica, California
LaTourette, Verne G.....	Phoenix
Lawson, Alice P.....	Pearce
Luis, Franklin A.....	Tucson
Lynch, Eugene R.....	Willcox
Minister, Percy F.....	Hesperia, California
Palmer, William E.....	Tempe
Rigg, Ralph Lee.....	Tucson
Rockfellow, Julia.....	Tucson

## JUNIORS

Arozena, Joe De.....	Tucson
Beach, Charles P.....	Los Angeles, California
Benzie, Inez M.....	Tucson
Brinton, Mary Rice.....	Tucson
Clark, Carl W.....	Tucson
Cloud, Leo F.....	Tucson
Condron, Albert H.....	Redwood City, California
Dill, Prentice W.....	Tucson
Fickett, Webster L.....	Tucson
Gammage, Grady.....	Tucson

Getsinger, Joseph W.	Phoenix
Gibbs, Gladys V.	Stilwell, Oklahoma
Graul, Leela Kinnear	Tucson
Graves, Leona S.	Inman, Kansas
Guild, Marilla Merriman	Tucson
Hedgpeth, John A.	Phoenix
Hoy, Catherine S.	Bisbee
Hughes, John E.	Tucson
Jones, Allan C.	Clifton
Jones, J. Preston	Phoenix
Kendall, Marcus T.	Tucson
Kreigbaum, Lawrence L.	Tucson
Lindsley, Richard G.	Tucson
McNeal, Roy W.	Tucson
Marshall, Thomas K.	Tucson
Minor, Bert	Phoenix
Oxley, Edward B.	Charleston, West Virginia
Peirce, Willard O.	Palo Alto, California
Pickrell, William W.	Phoenix
Pistor, Anna F.	Tucson
Pistor, Carl W.	Tucson
Porter, Asa	El Paso, Texas
Randall, Wainwright	Tucson
Record, Helen E.	Tucson
Rodee, Nona	Tucson
Rolph, Inez K.	Streator, Illinois
Sanderson, Murray	St. Louis, Missouri
Scheerer, George W.	Douglas
Sessions, Alma P.	Thatcher
Smith, Turner C.	Globe
Steinegger, William	Phoenix
Thriff, Inez E.	Phoenix
Thornber, Harriet Brown	Tucson
Voller, John W.	Tucson
Whisler, Lois G.	Tucson

## SOPHOMORES

Brown, Ruth Olive	Tucson
Cassidy, Barbara Estelle	El Paso, Texas
Chapman, John O.	Newton, Iowa
Clawson, George A.	Tucson
Cole, David, Jr.	Morenci
Crawford, Albert, Jr.	Prescott
Everest, Raymond B.	Oklahoma City, Oklahoma
Fickett, Fred W.	Tucson
Gardiner, John H.	Tucson
Gibson, Carlos E.	Bisbee
Grabe, William F.	Tucson
Grimshaw, Henry H.	Phoenix
Hannah, Bruce F.	Tucson
Harders, Hans H.	Globe
Hield, Horace H.	Tucson
Hobson, Francis J., Jr.	Nogales
Hobson, Harry T.	Nogales
Jolly, Mary L.	Jerome

Klein, Leonard.....	Tucson
Lask, Harold A.....	Pasadena, California
LaTourrette, Rena C.....	Phoenix
Leavitt, Frank N.....	El Monte, California
Leshner, Charles Z.....	Carbondale, Pennsylvania
McClure, Benjamin.....	Russellville, Arkansas
McClure, Frank G.....	Tucson
McPherson, Orville S.....	Yuma
McSherry, Frank J.....	Phoenix
Mack, Francis C.....	Tucson
Maffeo, James S.....	Bisbee
Martin, Horace B.....	Tucson
Martin, Jack B.....	Tucson
Odell, Mabel S.....	Tucson
Pickrell, Charles U.....	Phoenix
Pitrat, Julius E.....	Phoenix
Renaud, Ernest J.....	Pearce
Robbins, Wm. M.....	Phoenix
Russ, Ralph F.....	Harrisburg, Pennsylvania
Scheerer, Cedric E.....	Tucson
Schon, August L.....	Setange, Luxembourg
Schutte, Carl J. E.....	Transvaal
Schwalen, Harold C.....	Tucson
Spires, Ethel M.....	Tucson
Vaughan, Wallace W.....	Bisbee
Warner, Albert.....	Tucson
Waters, Josephine H.....	Douglas
White, Arthur L.....	Bisbee
Wright, Esther H.....	Phoenix

## FRESHMEN

Abell, Norman H.....	Tombstone
Acker, Nydia M.....	Prescott
Adams, I. C. E.....	Bisbee
Barnard, Justin F.....	Concord, New Hampshire
Beach, Chauncey W.....	Tucson
Bedford, Arthur H.....	Auckland, New Zealand
Brisley, Harold R.....	Prescott
Brown, Dudley S.....	Tucson
Carpenter, Harold D.....	Tucson
Carter, Ralph C.....	Tucson
Chapman, Edith M.....	Bisbee
Christy, Desmond S.....	Clifton
Clark, Homer.....	Prescott
Clawson, Leslie V.....	Tucson
Comstock, Jennie Lee.....	Tucson
Conley, William A.....	Douglas
Curry, Corlande B.....	Tucson
Duffy, Francis R.....	Nogales
Estill, Edward H.....	Tucson
Estill, Mary H.....	Tucson
Fulghum, Ruby E.....	Willcox
Garing, Robert S.....	Flagstaff
Griffith, Helen B.....	Tucson
Hammels, J. Vinton.....	Glendale



Hanson, LeRoy R.	Phoenix
Hays, George Vinton	Willcox
Hankins, Martha	Tucson
Heckman, Alice M.	Haverhill, Massachusetts
Hendry, James W.	Tucson
Howard, Charles H.	Prescott
Huddleston, Mildred F.	Tucson
Jackson, William A.	Tucson
Jacobus, Raymond H.	Tucson
Jaycox, Lester W.	Chandler
Jenney, William LeB.	Tucson
John, James D.	Tucson
Johnson, Jesse D.	Mesa
Johnson, William M.	Gonzales, Texas
Knegla, Louis E.	Tucson
Lawrence, Perry E.	Coquille, Oregon
Loflin, D. V.	Tucson
Lynch, Emzy H.	Yuma
McGowen, William R.	Miami
McRoberts, Margaret B.	Miami
Markham, Edgar A.	Seattle, Washington
Mayhew, Henry H.	Tucson
Meyer, Richard E.	Tucson
Miller, Ray F.	Coquille, Oregon
Muirhead, Coral M.	Bisbee
Nave, Marjorie	Tucson
Park, Lorna J.	Tucson
Parker, Grace	Tucson
Peacock, Thomas E.	Jerome
Peterson, George S.	Tucson
Prouty, Victor	Tucson
Roberts, Bertha M.	Mammoth
Reed, Ruth	Phoenix
Rogers, David W.	Pima
Ruppert, Carl E.	Phoenix
Ryan, Albert E.	Morenci
Sandige, John R.	Phoenix
Schoonmaker, Dorothy	Tucson
Seeley, George W.	Douglas
Sexton, Marshall C.	Rushville, Indiana
Stannard, Cedric	Phoenix
Steger, Adelaide L.	Tucson
Swaney, Oscar H.	Santa Monica, California
Terrell, Alfred Y.	Willcox
Tong, James A.	Johnson
Turvey, Harry E.	Douglas
Vinson, Katherine A.	Tucson
Warren, Howard S.	Bisbee
Westover, Harry C.	Yuma
Westover, William H.	Yuma
Whipp, Homer D.	Pomona, California
Whitehead, Lawrence	Indianapolis, Indiana
Wilson, Dorothy K.	Binghampton, New York
Windsor, Elsie M.	Willcox
Woo, Henry	Tucson
Woolf, Jesse A.	Tempe
Yoakum, Emile B.	Warren

## SPECIAL STUDENTS

Ahrens, Elizabeth B.	Tucson
Ashby, Rollo H.	Nogales
Austad, Alfred W.	Tucson
Bailey, Samuel G.	Tucson
Barth, Maurice	Tucson
Barnum, Laura English	Tucson
Bayze, Thomas S.	Nogales
Bockhoff, Harry W.	Richmond, Indiana
Buckley, Ruth S.	Tucson
Burson, Edgar A.	Tucson
Castaneda, Martha	Tucson
Chafin, Desdemona E.	Tucson
Clark, Gladys M.	Tucson
Clemons, Paquita	El Paso, Texas
Clemons, Philip de R.	El Paso, Texas
Curry, James W.	Tucson
Davison, Rowland O.	Carbondale, Pennsylvania
Deyo, Nelle Grundy	Tucson
Dunseath, Irene H.	Tucson
Dunseath, James R.	Tucson
Eberle, George L.	Pacific Grove, California
Emery, Julia McDaniels	Tucson
Enger, Mrs. A. L.	Tucson
Eskew, Roderick K.	Charleston, West Virginia
Estabrook, Minnie M.	Tucson
Evans, Elizabeth M.	Tucson
Farra, Shelly D.	Lexington, Kentucky
Feinstein, Harold	Tucson
Fogle, Gertrude	Tucson
Forbes, Helen C.	Tucson
Forbes, Mrs. R. H.	Tucson
Foster, Maude N.	Tucson
Freelande, Helen M.	East Orange, New Jersey
Freeman, Mrs. G. F.	Tucson
Geschwinder, Edith	Tucson
Gibbs, Paul H.	Stilwell, Oklahoma
Goldschmidt, Louise A.	Tucson
Grey, Frederick A.	Calistoga, California
Guinaw, Evelyn B.	Tucson
Hogan, Katherine S.	Tucson
Holohan, Mrs. W. B.	Tucson
Horstman, Edna Dugat	Tucson
Huffman, Edith G.	Tucson
Humphrey, Frank B.	Tucson
Hunsacker, Lois R.	Douglas
Hurst, Karl T.	Cornville
Ivancovich, Hertha C.	Tucson
Jenkins, Caröline M.	Tucson
Kelton, Eleanor H.	Tucson
King, Stella G.	Tucson
Kingan, Mary Mathews	Tucson
Kingan, Mary Bee	Tucson
Kitt, Ethel Tompkins	Tucson
Kitt, Mrs. Geo. F.	Tucson
Kruttschnitt, Marie Pickering	Tucson
Lannis, Santa E.	Tucson

Leeming, Bertha.....	Tucson
Long, Robert H.....	Buckeye
Lynch, Geo. Buford.....	Willcox
McCaddon, Mrs. L. R.....	Tucson
McCoy, John H.....	New York City
Magenheimer, Floriene R.....	Tucson
Magenheimer, Paul F.....	Tucson
Mansfeld, Phyllis.....	Tucson
Mariette, Catherine M.....	Bisbee
Marshall, Lydia Martin.....	Tucson
Mathews, Mabel G.....	Tucson
Metzger, Myrtle B.....	Tucson
Morse, Mrs. Stanley F.....	Tucson
Murphey, Elizabeth B.....	Tucson
Nave, Julia de.....	Tucson
Otis, Celeste Botiller.....	Tucson
Parker, Elmer E.....	Canille
Parker, Malvene.....	Tucson
Philipson, Mary T.....	Tucson
Pilcher, Cornelia.....	Tucson
Rebeil, Leonia.....	Tucson
Rebeil, Paul.....	Tucson
Reeves, Roloff W.....	Toltec
Renaud, Charles L.....	Pearce
Richman, E. Clinton.....	Tucson
Ronstadt, Fred A.....	Tucson
Rosenstern, Blanche A.....	Tucson
Roshe, Albert W.....	Tucson
Russell, Ernest E.....	Chandler
Seever, Carrie.....	Tucson
Shaw, Caroline M.....	Tucson
Steele, Lucile Johnston.....	Tucson
Stock, Milton J.....	Chicago, Illinois
Storts, James V.....	Prescott
Taylor, Mrs. Gibson.....	Tucson
Thomas, Charles L.....	Tucson
Troutman, Lucile E.....	Tucson
Vance, Calvert L.....	Casa Grande
Vanderdoes, Anna Helen L.....	Phoenix
Watson, Jané Shreeves.....	Tucson
White, Theresa G.....	Tucson
Whiteside, Thomas S.....	Chattanooga, Tennessee
Whitmore, Opal LeBaron.....	Tucson
Wilder, Charles Lucas.....	Tucson
Wood, Herbert R.....	Nogales
Woods, Gladys.....	Bisbee

## SUMMARY

Graduate Students.....	15
Seniors .....	18
Juniors .....	45
Sophomores.....	47
Freshmen.....	81
Special Students.....	102
Short Course (2 weeks) in Agriculture and Home Economics.....	143
Total.....	451

## RESIDENCE OF STUDENTS

## ARIZONA

Apache .....	1
Cochise .....	32
Coconino .....	1
Gila .....	5
Graham .....	4
Greenlee .....	4
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Pima .....	160
Pinal .....	2
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Yuma .....	5
<hr/>	
	259

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Arkansas .....	1
California .....	12
Illinois .....	2
Indiana .....	3
Iowa .....	1
Kansas .....	1
Kentucky .....	2
Massachusetts .....	1
Missouri .....	1
New Hampshire.....	1
New Jersey.....	1
New York.....	2
Oklahoma .....	3
Oregon .....	2
Pennsylvania .....	3
Tennessee .....	1
Texas .....	5
Washington .....	1
West Virginia.....	2
Wisconsin .....	1
<hr/>	
	46
Luxembourg .....	1
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	3

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# University of Arizona Record

THE  
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Annual Catalogue  
1915-1916

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To be filled out by the Superintendent or Principal of the school and mailed by him direct to

# UNIVERSITY OF ARIZONA

## TUCSON, ARIZONA

This certifies that M .....		..... attended .....	
Greek .....	.....	.....	.....
History .....	.....	.....	.....
Civics .....	.....	.....	.....
Physics .....	.....	.....	.....
Chemistry .....	.....	.....	.....
Botany .....	.....	.....	.....
Zoology .....	.....	.....	.....
Geology .....	.....	.....	.....
Physical Geography .....	.....	.....	.....
Physiology .....	.....	.....	.....
.....	.....	.....	.....

**UNIVERSITY OF ARIZONA**  
**TUCSON, ARIZONA**

This certifies that M ..... attended .....  
 ..... High School for ..... weeks and graduated ....., 191.....  
 The length of the course from which he graduated is ..... years of ..... weeks each.  
 The number of credits required for graduation is ..... Each credit represents a subject carried suc-  
 cessfully for ..... weeks with ..... recitations, or equivalent exercises of ..... minutes each, per week.  
 Below is given a detailed statement of the record of this student. Credits marked with a star were accepted  
 from .....

Address of the Student:

Signature .....

Official Position .....

Address .....

(Street and Number)

Date of this Certificate .....

## DETAILED STATEMENT OF WORK

SUBJECTS	No. of Credits	No. of Weeks	Times a Week	Length of Recitation Period	Grade
English, 1st yr. ....					
English, 2nd yr. ....					
English, 3rd yr. ....					
English, 4th yr. ....					
Algebra .....					
Plane Geometry ..					
Solid Geometry ..					
Trigonometry ..					
Latin .....					
German .....					
French .....					
Spanish .....					
Greek .....					
History .....					
Civics .....					
Physics .....					
Chemistry .....					
Botany .....					
Zoology .....					
Geology .....					
Physical Geography					
Physiology .....					
.....					
.....					

# University of Arizona

## Twenty-fifth Annual Catalogue 1915-1916

### Announcements for 1916-1917

THE UNIVERSITY OF ARIZONA RECORD  
Volume IX, Number 4 May, 1916  
TUCSON, ARIZONA

EW

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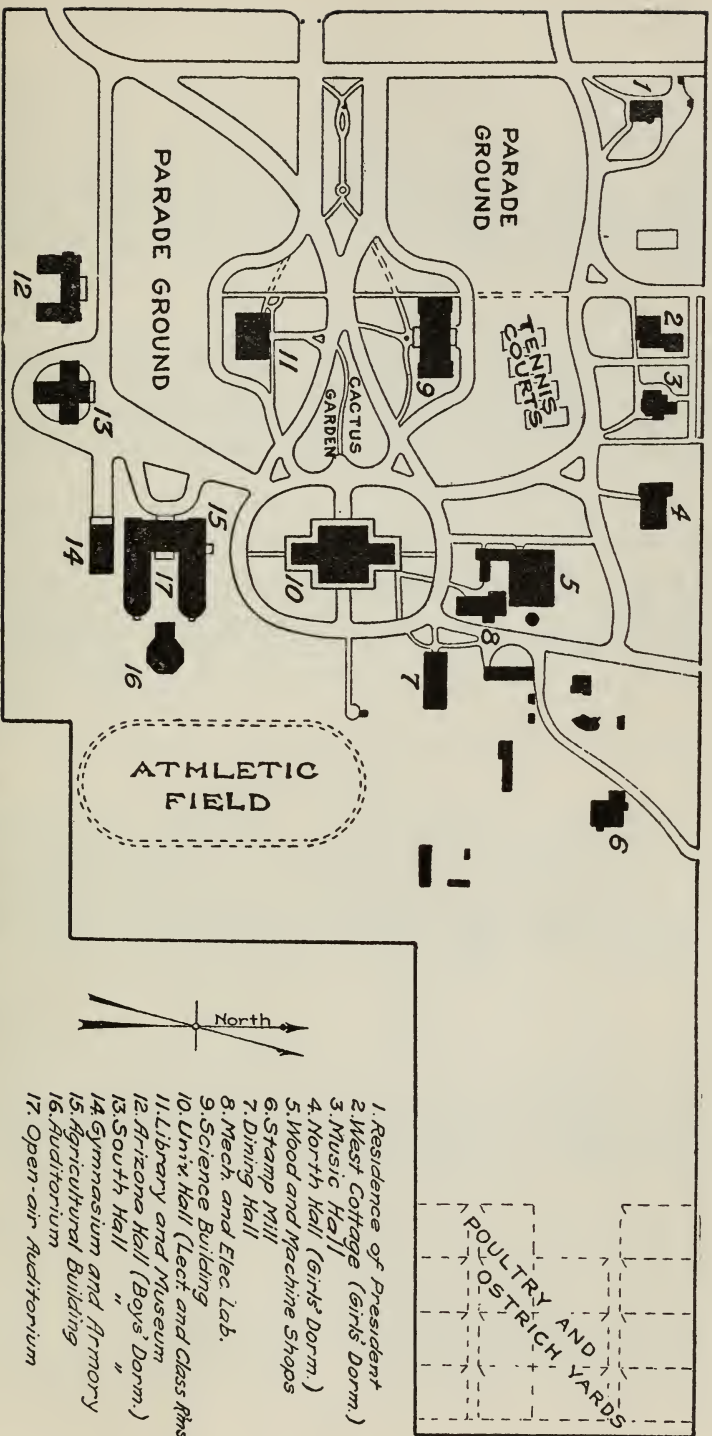
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# UNIVERSITY of ARIZONA

1916

JANUARY

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
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FEBRUARY

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MARCH

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1917

JANUARY							FEBRUARY							MARCH							APRIL						
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14	15	16	17	18	19	20	11	12	13	14	15	16	17	11	12	13	14	15	16	17	15	16	17	18	19	20	21
21	22	23	24	25	26	27	18	19	20	21	22	23	24	18	19	20	21	22	23	24	22	23	24	25	26	27	28
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MAY							JUNE							JULY							AUGUST						
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SEPTEMBER							OCTOBER							NOVEMBER							DECEMBER						
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30																					30	31					



# UNIVERSITY CALENDAR

1916-1917

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## FIRST SEMESTER

September 15, 16 Friday and Saturday	Matriculation and registration of new students Entrance examinations
September 18, Monday	Registration of old students
September 19, Tuesday	Class work begins
September 23, Saturday	Condition examinations
September 30, Saturday	"A" Day
November 23, Thursday	Thanksgiving Day (Holiday)
December 22, Friday even- ing to January 2, Tues- day evening	Christmas recess
January 6, Saturday	Condition examinations
January 22, Monday	Semester examinations begin

## SECOND SEMESTER

January 29, Monday	Last day of registration
January 30, Tuesday	Class work begins
February 22, Thursday	Holiday
April 14 to 18, Saturday to Wednesday	Annual encampment of bat- talion
April 16 to 21, Monday to Saturday	University Week
May 12, Saturday	Condition examinations
May 26, Saturday	Junior Day
May 27, Sunday	Baccalaureate Sunday
May 28, Monday	Senior Day
May 29, Tuesday	Alumni Day
May 30, Wednesday	Commencement
June 2, Saturday	Semester examinations end

# ORGANIZATION OF THE UNIVERSITY

---

The University comprises the following colleges and departments:

College of Letters, Arts, and Sciences, including among others—

Departments of Law, Education, and Music

College of Agriculture

Agricultural Experiment Station, including—

Range Study Tracts, Tucson

Experiment Station Farm, Phoenix

Date-Palm Orchard, Tempe

Demonstration Farm and Date-Palm Orchard, Yuma

Northeastern Dry-Farm, Snowflake

Prescott Dry-Farm, Prescott

Sulphur Spring Valley Dry-Farm, Cochise

University Farm, Tucson

Experimental and Demonstration Farm, Mesa

College of Mines and Engineering

State Bureau of Mines

University Extension Service, including—

General Extension Department

Agricultural Extension Department

# OFFICERS OF THE UNIVERSITY

---

## BOARD OF REGENTS

### EX-OFFICIO

HIS EXCELLENCY, GEORGE W. P. HUNT .....Phoenix  
*Governor of Arizona*

THE HONORABLE CHARLES O. CASE .....Phoenix  
*Superintendent of Public Instruction*

### APPOINTED

FRANK H. HEREFORD .....Tucson  
*President of the Board and Chancellor*

LEWIS D. RICKETTS, Ph. D. ....Warren

WILLIAM SCARLETT, A. B., B. D. ....Phoenix

RODERICK D. KENNEDY, M. D. ....Globe

WILLIAM V. WHITMORE, A. M., M. D. ....Tucson

RUDOLPH RASMESSEN .....Tucson

FRANK J. DUFFY .....Nogales

WILLIAM JENNINGS BRYAN, JR., A. B., Secretary.....Tucson

## COUNCIL OF ADMINISTRATION

RUFUS BERNHARD VON KLEINSMID, A. M., Sc. D.

*President*

ROBERT HUMPHREY FORBES, M. S., Ph. D.

*Dean, College of Agriculture,  
Director Agricultural Experiment Station.*

ANDREW ELLICOTT DOUGLASS, Sc. D.

*Dean, College of Letters, Arts,  
and Sciences*

GURDON MONTAGUE BUTLER, E. M.

*Dean, College of Mines and  
Engineering*

# OFFICERS OF INSTRUCTION AND INVESTIGATION

1915-1916

The names of officers are arranged in groups according to seniority of appointment to present rank.

RUFUS BERNHARD VON KLEINSMID, A. M., Sc. D. *President*  
*Professor of Philosophy and Psychology* President's House

ROBERT HUMPHREY FORBES, M. S., Ph. D. 105 Olive Road  
*Dean of College of Agriculture; Director, Agricultural Experiment Station*

\*FRANK NELSON GUILD, M. S. 107 Olive Road  
*Professor of Chemistry and Mineralogy*

GEORGE EDSON PHILIP SMITH, B. S., C. E. 1195 Speedway  
*Irrigation Engineer, Agricultural Experiment Station*

JOHN JAMES THORNER, B. S., A. M. 109 Olive Road  
*Professor of Botany; Botanist, Agricultural Experiment Station*

CHARLES ALFRED TURRELL, B. S., A. M., *Lic en Letras* 835 Tyndall Ave  
*Professor of Romance Languages*

WILLIAM WHEELER HENLEY, A. B. First St. near Vine  
*Professor of Mechanical Engineering and Mechanic Arts*

ALBERT EARL VINSON, Ph. D. 627 E. First St.  
*Professor of Agricultural Chemistry; Biochemist, Agricultural Experiment Station*

ANDREW ELLICOTT DOUGLASS, A. B., Sc. D. 1189 Speedway  
*Dean of College of Letters, Arts, and Sciences; Professor of Physics, and Astronomy*

LESLIE ABRAM WATERBURY, B. S., C. E. 1405 Speedway  
*Professor of Civil Engineering*

\*GEORGE FOUCHE FREEMAN, B. S. 641 N Park Ave.  
*Professor of Plant Breeding; Plant Breeder, Agricultural Experiment Station; Acting Dean College of Agriculture and Director Agricultural Experiment Station*

AUSTIN WINFIELD MORRILL, Ph. D. 348 W Portland St., Phoenix  
*Consulting Entomologist, Agricultural Experiment Station*

---

\*On leave 1916-17.

- \*FRANCES MELVILLE PERRY, A. M. 1207 Speedway  
*Professor of Composition and Rhetoric*
- CHARLES ARTHUR MESERVE, Ph. D.  
*Professor of Bacteriology and Food Chemistry*
- CHARLES HORACE CLAPP, Ph. D. 824 N Euclid Ave.  
*Professor of Geology*
- GEORGE LEROY BROWN, Colonel U. S. A. 9 Hinchcliffe Court  
*Professor of Military Science and Tactics*
- STANLEY FLETCHER MORSE, B. A. S. 127 E Third St.  
*Superintendent, Agricultural Extension Department*
- PAUL HENRY MALLETT-PREVOST BRINTON, Ph. D. 115 Olive Road  
*Professor of Analytical Chemistry*
- RICHARD HERMON WILLIAMS, Ph. D. Arizona Hall  
*Professor of Animal Husbandry; Animal Husbandman, Agricultural Experiment Station*
- †ELMER J. BROWN, Ph. D.  
*Professor of Social Science.*
- GURDON MONTAGUE BUTLER, E. M. 827 E Fourth St.  
*Dean of College of Mines and Engineering*
- BYRON CUMMINGS, A. M. Mabel Ave.  
*Professor of Archaeology; Director of the Museum*
- JOHN FREDERICK NICHOLSON, M. S. 592 N Park Ave.  
*Professor of Agronomy; Agronomist, Agricultural Experiment Station*
- WILLIAM GEORGE MEDCRAFT, A. M. 726 E Fifth St.  
*Associate Professor of Mathematics*
- ARTHUR HAMILTON OTIS, A. B. 639 N Park Ave.  
*Associate Professor of German*
- HERMAN BURR LEONARD, Ph. D. South Hall  
*Associate Professor of Mathematics*
- GEORGE H. CRESSE, A. M. 905 N Euclid Ave.  
*Associate Professor of Mathematics*
- †THOMAS G. CHAPMAN, B. S.  
*Associate Professor of Metallurgy and Ores.*
- †LEVONA PAYNE NEWSOM, Ph. D. 804 E Fourth St.  
*Assistant Professor of Latin and Greek*

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\*On leave 1916-17.

†Resigned.

‡Appointed May, 1916.



FRANK CALEB KELTON, M. S. <i>Assistant Professor of Civil Engineering</i>	412 E Fourth St.
ESTELLE LUTRELL, A. B. <i>Assistant Professor of English Literature; Librarian</i>	637 N Park Ave.
CHARLES FRANCIS WILLIS, B. S. <i>Assistant Professor of Mining Engineering; Director, Bureau of Mines</i>	725 E Fourth St.
*IDA CHRISTINA REID, Ph. M. <i>Assistant Professor of History; Dean of Women</i>	North Hall
HOWARD ARCHIBALD HUBBARD, A. M. <i>Assistant Professor of History and Social Science</i>	109 Olive Road
DEROSSETTE THOMAS, B. S. <i>Assistant Professor of Home Economics</i>	720 University Ave.
ALVA OTIS NEAL, M. S. <i>Assistant Professor of Education; Registrar; High School Visitor</i>	South Hall
ARTHUR LUDWIG ENGER, B. S. <i>Assistant Irrigation Engineer, Agricultural Experiment Station</i>	526½ Tyndall Ave.
CLIFFORD NORMAN CATLIN, A. M. <i>Assistant Professor of Chemistry; Assistant Chemist, Agricultural Experiment Station</i>	
WALTER S. CUNNINGHAM, B. S. <i>Assistant Professor of Animal Husbandry, Assistant Animal Husbandman, Agricultural Experiment Station</i>	721 E Fourth St.
STEPHEN BARNWELL JOHNSON, B. S. <i>Assistant Professor of Horticulture; Assistant Horticulturist, Agricultural Experiment Station</i>	1390 E Fifth St.
GEORGE WALLACE BARNES, B. S. <i>Livestock Specialist, Agricultural Extension Department</i>	810 E Sixth St.
ROY STEVENSON KING, M. E., M. S. <i>Assistant Professor of Mechanical Engineering</i>	905 N Euclid Ave.
JESSAMINE CHAPMAN WILLIAMS, B. S. <i>Assistant Professor of Home Economics</i>	Arizona Hall
†SYDNEY JOSEPH FRANK, J. D. <i>Assistant Professor of Law</i>	606 N Park Ave.
†HOWARD MILTON COLVIN, LL. B. <i>Assistant Professor of Law</i>	637 N Park Ave.

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\*On leave 1916-17.

†Resigned.

SAMUEL MARKS FEGTLY, LL. B. <i>Assistant Professor of Law</i>	1025 E Fifth St.
HERBERT HAMILTON FOSTER, Ph. D. <i>Assistant Professor of Education and Psychology</i>	819 N First Ave.
CHARLES TAYLOR VORHIES, Ph. D. <i>Assistant Professor of Biology</i>	528½ Tyndall Ave.
ELMER E. MOOTS, M. S., C. E. <i>Assistant Professor of Civil Engineering</i>	816 E Fifth St.
JAMES GREENLEAF BROWN, M. S. <i>Instructor in Botany and Zoology</i>	89 E Alameda St.
†ELSA CHAPIN, A. B. <i>Instructor in English and Physical Training for Women</i>	720 E Third St.
ANITA CALNEH POST, Ph. B. <i>Instructor in Romance Languages</i>	832 E Fifth St.
JOHANNES CORNELIUS THEODORUS UPHOF <i>Instructor in Plant Breeding; Assistant Plant Breeder, Agricultural Experiment Station</i>	207 E Third St.
WILLIAM SEATON HENDRY <i>Instructor in Mechanic Arts</i>	903 E Seventh St.
THOMAS WITT FITZGERALD, B. S. M. E. <i>Instructor in Mechanical Engineering</i>	521 E Third St.
ISIDOR COLODNY, M. A. <i>Instructor in English</i>	Center and Speedway
GRACE LYMAN, M. A. <i>Instructor in Psychology</i>	West Cottage
IDA WHITTINGTON DOUGLASS, Ph. B. <i>Instructor in History of Music</i>	1189 Speedway
‡ALLEGRA FRAZIER, A. B. <i>Instructor in Composition and Rhetoric.</i>	
‡HOWARD WILMOT ESTILL, M. S. <i>Instructor in Chemistry.</i>	
‡ANNA BISHOP, <i>Instructor in Home Economics.</i>	

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†Resigned.

‡Appointed May, 1916.

- HERMAN CLAUDE HEARD 721 E Fourth St.  
*Assistant Agronomist, Agricultural Experiment Station*
- WALTER EDWARD BRYAN 621 Park Ave.  
*Assistant Plant Breeder, Agricultural Experiment Station*
- ESTMER W. HUDSON  
*Cotton Specialist, Agricultural Extension Department*
- ARTHUR LEE PASCHALL, B. A. S.  
*County Farm Demonstrator, Agricultural Experiment Station*
- JAMES ALEXANDER ARMSTRONG, B. S.  
*County Farm Demonstrator, Agricultural Experiment Station*
- LELAND F. PARKER  
*State Club Agent, Agricultural Extension Department*
- CHARLES R. FILLERUP  
*County Farm Demonstrator, Agricultural Experiment Station*
- EDITH C. SALISBURY  
*Instructor in Home Economics, Agricultural Extension Department*

## FELLOW ASSISTANTS

- PHINEAS E. JOSEPH, M. S. *Assistant in Metallurgy*
- FRANK L. CULIN, JR., M. S. *Assistant in Mining Engineering*
- PERCY F. MINISTER, M. S. *Assistant in Chemistry*
- PERCY W. MOORE, M. S. *Assistant in Agricultural Chemistry*
- T. E. SCHREINER *Assistant in Animal Husbandry*
- ‡LAURA E. HOLMES, A. B. *Assistant in Romance Languages*

## STUDENT ASSISTANTS

- JOE D. AROZENA *Assayer, Bureau of Mines*
- HORACE HIELD *Assistant in Physics*
- PAUL H. GIBBS *Assistant in Biology*
- ALBERT CRAWFORD, JR. *Assistant in Chemistry*

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‡Appointed May, 1916.

ASSISTANTS IN MILITARY SCIENCE AND TACTICS

CHARLES A. MESERVE, Ph. D., N. G. A.	<i>Lecturer, Aviation and Signaling</i>
IRWIN EWEN HUFFMAN, M. D., N. G. A.	<i>Lecturer in Military Hygiene</i>
FREDERICK DICKLEY, U. S. A.	<i>Ordnance Officer</i>
MYRON G. BROWNE, N. G. A.	<i>Commandant of Cadets and Director of Rifle Practice</i>
FRANK J. CULIN, JR.	<i>Assistant Commandant of Cadets</i>
RICHARD L. LINDSLEY	<i>Assistant in Rifle Practice</i>
ALLAN C. JONES	<i>Assistant in Rifle Practice</i>
JOHN A. HEDGPETH	<i>Assistant in Military Sanitation and Hygiene</i>
CEDRIC E. SCHEERER	<i>Quartermaster</i>

**EXECUTIVE OFFICERS**

<b>RUFUS BERNHARD VON KLEINSMID</b> , A. M., Sc. D.	<i>President</i>
<b>ANDREW ELLICOTT DOUGLASS</b> , A. B., Sc. D.	<i>Secretary, Academic Science</i>
<b>ROBERT HUMPHREY FORBES</b> , M. S., Ph. D.	<i>Director, Agricultural Experiment Station</i>
<b>ALVA OTIS NEAL</b> , M. S.	<i>Registrar and High School Visitor</i>
<b>IDA CHRISTIANA REID</b> , Ph. M.	<i>Dean of Women</i>
<b>CASELL WESLEY ADKINSON</b>	<i>Financial Secretary</i>
<b>ESTELLE LUTRELL</b> , A. B.	<i>Librarian</i>
<b>CHARLES FRANCIS WILLIS</b> , B. S.	<i>Director, Bureau of Mines</i>
<b>BYRON CUMMINGS</b> , A. M.	<i>Director of the Museum</i>
<b>STANLEY FLETCHER MORSE</b> , B. A. S.	<i>Superintendent, Agricultural Extension Department</i>
<b>CHARLES EDWARD GRASSICK</b>	<i>Purchasing Agent</i>
<b>ADA ENGLISH</b>	<i>Secretary to the President</i>
<b>GRACE B. LYMAN</b>	<i>Resident Head of West Cottage</i>
<b>THOMAS R. BLAIR</b>	<i>Bookkeeper</i>
<b>MYRON G. BROWNE</b>	<i>Assistant Bookkeeper</i>
<b>WILLIAM J. BRAY</b>	<i>Superintendent of Buildings</i>
<b>KATHERINE BARKER</b>	<i>Stewardess, University Dining Hall</i>
<b>FOSTER T. PARKER</b>	<i>Secretary, Agricultural Extension Department</i>
<b>HELEN M. A. MILLER</b>	<i>Secretary, Agricultural Experiment Station</i>
<b>ALICE M. HECKMAN</b>	<i>Secretary, Bureau of Mines</i>
<b>ALTA WHEELER</b>	<i>Assistant in the Museum</i>
<b>DWIGHT L. VON SCHAUSSEN</b>	<i>Clerk, President's Office</i>
<b>GLADYS V. GIBBS</b>	<i>Clerk, Registrar's Office</i>
<b>JOSE HIGUERA</b>	<i>Head Gardener</i>

**LIBRARY OFFICERS**

<b>ESTELLE LUTRELL</b> , A. B.	<i>Librarian</i>
<b>MABEL AENELLA GUILD</b>	<i>General Assistant Librarian</i>
<b>HELEN M. A. MILLER</b>	<i>Assistant in Agriculture</i>
<b>JOSEPHINE WATERS</b>	<i>Catalogue Assistant</i>
<b>MARY L. JOLLY</b>	<i>Accession Assistant</i>
<b>HARRY C. WESTOVER</b>	<i>Shelf Assistant</i>



## COMMITTEES OF THE FACULTY

1915-1916

### ADMINISTRATION :

*President von KleinSmid, Dean Douglass, Dean Forbes, Dean Butler, Professors Guild, Waterbury, Thornber, Cummings, Reid, Neal.*

### ALUMNI RELATIONSHIP :

*Professors Smith, Kelton, Reid, Miss Post.*

### ASSEMBLY :

*Dean Douglass, Professors Perry, Newsom, Johnson, Vorhies, Foster.*

### ATHLETICS :

*Mr. McKale, Col. Brown, Professors Medcraft, Enger, Colvin, Moots.*

### CORRESPONDENCE WORK :

*Professors Clapp, Leonard, Foster, Vorhies.*

### CURRICULUM :

*Professors Clapp, Brinton, Turrell, Butler, Cummings.*

### DELINQUENT STUDENTS :

*Professors Turrell, Hubbard, Freeman, Cresse.*

### DOUGLAS FUND :

*Dean Douglass, Professors Guild, Henley.*

### EXTENSION WORK :

*Professor Newsom, Dean Forbes, Dr. Meserve, Professors Morse, Willis, Mrs. Williams.*

### GRADUATE STUDY :

*Professors Guild, Butler, Vinson and the professors in whose department work is being done.*

### LIBRARY :

*Professors Lutrell, Perry, Smith, Hubbard, Waterbury, Otis, Frank.*

### PROGRAM :

*Professors Henley, Turrell, Freeman, King.*

### PUBLICATIONS :

*Professors Perry, Morse, Willis, Thornber, Foster, Mr. Colodny.*

### RECOMMENDATION :

*Professors Neal, Newsom, Willis, Thomas, Cunningham, King.*

### REGISTRATION :

*Professors Neal, Henley, Vinson, Otis, Leonard, Fegtly.*

**RHODES SCHOLARSHIP:**

*President von KleinSmid, Professor Guild, Dean Douglass.*

**SOCIAL LIFE STUDENT ENTERPRISES:**

*Professors Reid, Williams, Luttrell, Frank, Miss Chapin, Mr. Colodny.*

**SPECIAL UNIVERSITY OCCASIONS:**

*Professors Otis, Medcraft, Kelton, Thomas, Col. Brown, Mr. Catlin, Miss Post.*

**STUDENT LOAN FUND:**

*Professors Brinton, Waterbury, Smith.*

**STUDENT RESIDENCES:**

*Professors Neal, Williams, Dean Reid, Miss Lyman.*

# GENERAL INFORMATION

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## PURPOSE AND GOVERNMENT

### General Statement

The University of Arizona is an integral part of the system of public education established by and for the State. Its purpose, in the language of the organic law, is "to provide the inhabitants of this State with the means of acquiring a thorough knowledge of the various branches of literature, science, and the arts," and, in so far as possible, a technical education adapted to the development of the peculiar resources of Arizona. In furtherance of this purpose the College of Letters, Arts, and Sciences, the College of Mines and Engineering, the State Bureau of Mines, the College of Agriculture, and the Agricultural Experiment Station, have been organized. In creating the University, the Legislative Assembly wisely unified under one management these various schools and institutions of higher learning and investigation.

The general organization of the University is in accordance with the Act of Congress of July 2, 1862, known as the Morrill Act, creating the "Land Grant Colleges." The details of its organization and government are regulated by the Act of the Legislative Assembly of the Territory of Arizona, passed in 1885, and embodied, with amendments, in the Revised Statutes of 1901.

### The Board of Regents

The government of the institution is vested in a corporation styled the Board of Regents of the University of Arizona, consisting of the Governor and the Superintendent of Public Instruction of the State, ex-officio, and eight members appointed by the Governor, not more than four of whom shall belong to the same political party. The appointment is made subject to the advice and consent of the Senate. The term of office is four years, beginning on the first Monday in August succeeding the appointment, and continuing until the appointment of a successor. In case of vacancy the Governor fills the office by appointment and the person so selected remains in office till the close of the next legislature and until another selection is made. The Board elects a presiding officer

who is Chancellor of the University and, ex-officio, President of the Board. It also selects its own Secretary, Treasurer, and Librarian.

The Board of Regents has power to control and manage the University and its properties, to enact laws governing the University, to appoint and employ a President of the University and the requisite number of professors and tutors, and to determine salaries. While the immediate government of the various departments is placed in the faculties, the Board of Regents has power to regulate instruction and under advice of the faculty to prescribe books and authorities used therein. It has the power to confer degrees and grant diplomas as is usual in such institutions. The regular meetings of the Board are held on or near the tenth of each month.

### **Faculties**

The University Council—The University Council of Administration is composed of the President and Deans of the several colleges of which the University is composed, and is to exercise such powers as the Board of Regents may confer upon it.

The Academic Senate—The Academic Senate is composed of the Faculties of the University, and must conduct the general administration of the University, regulate the general and special courses of instruction, receive and determine all appeals from acts by the Faculty of any college, and exercise such other powers as the Board of Regents shall confer upon it. The proceedings of the Senate must be conducted according to the rules of order adopted by it, and every person engaged in instruction in the University may participate in its discussion. The right of voting, however, is confined to the President, Professors, Associate Professors, and Assistant Professors.

The Faculties of the Several Colleges—The immediate government of the several colleges is entrusted to their respective Faculties, each of which must have its own organization, regulate its own immediate affairs, subject to the approval of the academic senate, and may recommend courses of study and text-books to be used.

## **MAINTENANCE AND ENDOWMENT**

The University is maintained by funds appropriated by the United States and by the State of Arizona.

Federal Support—By the provisions of the Morrill Act of 1890, the University receives annually from the United States

the sum of \$25,000 "to be applied only to instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life, and to the facilities for such instruction." This Morrill Fund is duplicated by the Nelson Fund, created by the Act of March 4, 1907. The University receives from the same source, for the support of the Agricultural Experiment Station, \$15,000 yearly, from the Hatch Act of 1887, and \$15,000 additional from the Adams Act of 1906. \$11,715.47 for 1915-16, and \$13,145.03 for 1916-17 are the Federal appropriations for the Agricultural Extension Service. Fifty-seven sections of valuable pine land in Coconino County have been set apart by the Federal government for the benefit of the University, a small sum being annually received from the leases of this land.

**State Appropriations**—The appropriations of the Legislature for the biennium 1915-17 are, for maintenance, \$224,156.80; general improvements, \$25,526.50; extension work throughout the state, \$20,000.00; experiment and instruction farms in the state and experiment work at the University, \$78,060.00; Bureau of Mines work, \$10,000.00; constructing a central heating, lighting, and power plant, \$48,000.00; constructing a Mines and Engineering building, \$75,000.00; purchasing additional land for the campus, \$5,000.00.

**Gifts and Endowments**—By the munificence of Doctor James Douglas, of New York, the University received in June, 1908, the sum of \$10,000, the income from which is to be annually applied for the purchase of instruments of precision and research, or special apparatus, for scientific instruction and education in the Department of Mineralogy and School of Mines of the University of Arizona. The fund thus created has been named the Douglas Endowment Fund.

In order to make possible the erection of a suitable building for the work of the College of Mines and Engineering several of the larger companies producing copper in the State have pledged themselves to contribute \$100,000, which is to be added to the State appropriation of \$75,000, made for the same purpose.

The University also receives annually a small amount from miscellaneous sources such as matriculation, tuition, and dormitory fees.



## HISTORY

The Act of Legislative Assembly making possible the University of Arizona was passed in 1885. By 1890 three of the departments for which it provided, the Agricultural Experiment Station, the College of Agriculture, and the College of Mines and Engineering, were organized, and in 1891 the University was opened to students. The history of the University of Arizona for the first twenty-five years of its existence has been closely related to the educational history of the State. When it was opened in October, 1891, with a faculty of eight professors and instructors, only thirty-one students, all told, matriculated, and only nine of these were of Freshman rank; the remaining twenty-two were taken care of in a Preparatory Department. For the first eighteen years the preparatory students outnumbered the University students. But in order to encourage the growth of the high schools throughout the State, the University refused to admit to its Preparatory Department, students coming from communities large enough to support local high schools. By 1911 the State was so well provided with such schools that the University announced its intention of closing the Preparatory Department by withdrawing each year the work of the lowest class of the preceding year. The first step towards the execution of this policy was taken in 1912-13, and in June, 1915, the permanent closing of the Preparatory Department was effected.

The increase in the number of college students has been more than sufficient to offset the decrease in the number of preparatory students. The membership of the University proper has shown a steady, normal growth gratifying in a pioneer state, in which the industrial basis that makes the privilege of higher education a matter of course, is still in process of establishment. To secure this growth and develop a University worthy to rank among older State Universities and competent to offer to the youth of the Commonwealth just educational advantages, Arizona has been obliged rapidly to expand and enrich the various departments of instruction in the University, and to that end has provided a faculty and academic equipment of high order for a College of Letters, Arts, and Sciences, a College of Mines and Engineering, and a College of Agriculture.

## LOCATION AND CLIMATE

**General Statement**—The University of Arizona is situated at Tucson, a city of eighteen thousand inhabitants, on the

main lines of the Southern Pacific Railway, and the El Paso and Southwestern System, 312 miles west of El Paso, Texas, and 500 miles east of Los Angeles, California. The city lies in a broad valley at an elevation of 2,400 feet above sea level and is surrounded by mountains.

**Advantages of Location for Students of Engineering**—Because of its situation in the neighborhood of great mines, the University offers exceptional advantages to the students of mining engineering through the opportunity it affords them of seeing the actual operation of mines and the development of great enterprises, while carrying on the theoretical and experimental work of the mining course. As Tucson is a railroad center of some importance and the engineering headquarters for several lines of the Southern Pacific system, the students of civil engineering also are provided with a field for observation and vacation employment.

**Advantages of Location for Students of Agriculture**—The situation of the University is favorable for students of agriculture as well as for students of engineering. Tucson has many irrigated farms in its neighborhood, is near the great range country of Southern Arizona, and occupies a central position with relation to the agricultural activities of the State. The University has kept pace with the growing interest and investment in agriculture in the State and has adapted its instruction and research in this science to the special needs of the State.

**Advantages of Location for Students of Astronomy**—In natural advantages the University, with all Southern Arizona, is even more highly favored by a climate which is perhaps the best in the United States for astronomical observations. The fine weather day after day, the quietness of the air at night, and the freedom of the winters from snow, all contribute to a consecutiveness of observation day by day such as is found practically nowhere else, and to a perfection of the atmospheric conditions that renders the most exacting work possible.

**Climatic Advantages**—The situation of the University is fortunate not only by reason of its adaptation to these lines of work but also because of the advantages it offers from the point of view of general wellbeing. Its dry, mild, and equable climate has made Tucson a winter resort unsurpassed for healthfulness. Little rain falls during the winter; fogs are all but unknown; cloudy days are rare. The percentage of sun-

shine throughout the winter is greater than that recorded at any other place in the United States. Owing to the extreme dryness of the air the highest temperatures known are less oppressive to the senses and less dangerous to the health than the summer heats of the upper Mississippi Valley states. The total amount of rainfall for the year averages less than twelve inches, half of which comes in the months of July, August, and September. These advantages insure to students a comfortable education and a wide range of out-door recreation throughout the college year.

## GROUNDS

The University Campus, consisting of sixty acres, is situated upon high ground about a mile from the business center of Tucson with which it is connected by an electric car line. On every side it commands a view of mountain scenery of remarkable extent and grandeur. Carefully laid out in drives, lawns, and gardens, with a large number of palm, olive, ash, umbrella, pepper, bagota, and cottonwood trees, the Campus has the air of a well kept park.

The University has its own water supply system for fire-protection, irrigation, laboratory, and domestic purposes. The water is drawn from deep wells, and is of exceptional purity, chemically and bacteriologically. A new well, drilled in 1915, has a capacity of 1500 gallons a minute, ample for the needs of the institution for many years to come. The Campus has a complete sewer system connecting the buildings with the city mains at the University gate. The buildings are lighted by electricity.

## BUILDINGS

University Hall, the oldest of the University buildings, contains recitation rooms, laboratories and apparatus rooms of various departments, and an assembly room.

The Library, a structure of red brick and Bedford sandstone, contains the library reading room, the stack rooms, work rooms for the library; departmental conference rooms; and room for the Department of Geology, and the Department of German.

Science Hall, a building of architecture harmonious with the Library, which it faces, is of three stories, the first devoted to physics, the second to chemistry and mineralogy, and the

third to chemistry, biology, and civil engineering. A superstructure on the roof is used as an astronomical observatory.

Agriculture Hall, a commodious new building of brick and reinforced concrete, provides temporary administration offices, and permanent quarters for the University Museum, the College of Agriculture, and the Department of Home Economics.

The Shop and Assay Building contains well equipped class rooms, laboratories, shops, and instrument rooms for various departments of engineering.

The Mill or Mining Machinery Building is a plain wooden structure equipped with stamp mills, jigs, concentrating tables, separators, and other machinery necessary for the mining laboratory.

The Mechanical and Electrical Laboratory houses the equipment for the Mechanical and Electrical Engineering Departments in addition to the fire and service pumps, and boilers for heating and experimental purposes.

Music Hall provides music rooms and recitation rooms for the Departments of Music and Art.

Herring Hall, the gymnasium, 40 x 80 feet in size, is the gift of Professor James Douglas and his associates of the Copper Queen Consolidated Mining Company, through Colonel William Herring, after whom it was named, at the suggestion of Professor Douglas.

The Auditorium, having a seating capacity of five hundred, accommodates University meetings and student assemblies. Its stage, when opened on the patio between the wings of Agriculture Hall, completes an open air theater seating about twelve hundred.

The President's House is situated at the west end of the north drive.

Pima Hall and West Cottage provide dormitory accommodations for about forty women. Each hall has its parlor, living rooms, modern sanitary equipment, and sleeping-porches.

Arizona Hall and South Hall provide dormitory accommodations for about one hundred men. Both halls are admirably suited to their purpose and in addition to the customary equipment, provide spacious sleeping-porches.

The Dining Hall provides boarding accommodations for all persons living on the Campus.

A Mines and Engineering Building and a central heat, light, and power plant, are in process of construction.



## GENERAL EQUIPMENT

**The University Library**

**The Reading Rooms**—The Library Building was erected in 1904 for the combined use of the Library and Museum. Upon the removal of the Museum to the new Agriculture Building in the summer of 1915, that division of the main floor, upon which the collections had been displayed was occupied by the Library as a general reading room. Supplied, as it now is, with suitable equipment, it affords accommodations for about 100 readers. In one section of the old reading room additional stacks have been installed, while the remaining space has been converted into a faculty study, law library, and periodical room.

In the general reading room are about 600 reference books—encyclopedias, dictionaries, periodical guides, the books reserved by instructors for collateral reading, and the card catalogues. Some fifty magazines are also to be found here, together with the current numbers of many of the local papers, and the college exchanges.

**Accessions**—The Library now contains 23,800 bound volumes exclusive of public documents, and several thousand unbound bulletins and reports. The present appropriations provide for an annual increase of about 1200 volumes. About one-fourth of these accessions come from binding periodicals, of which the library has over 200 on its subscription list. The back files of these periodicals show thirty-eight complete sets, and forty-one long runs nearly complete. Important additions to these sets form a part of the yearly expenditure of the library funds. In addition to the accessions acquired by purchase the Library receives as a depository the documents and publications of the United States Government and the publications of the Carnegie Institution.

**The Law Library**—The establishment of a law school made it necessary to enlarge materially the collection of books in that department, which had hitherto been provided for under the apportionment for economics. A good beginning has been made in the organization of this section, and the books are kept in the general library where they are easily accessible.

**Classification and Catalogues**—The books are classed by the decimal system and shelved in numerical order with a further author division according to the Cutter numbers. The catalogue is the usual dictionary catalogue of authors, subjects, and titles in one alphabetical arrangement. Printed cards from



the Library of Congress are used, supplemented by typewritten cards for books reported not in their stock. There is also a card catalogue of the publications of the U. S. Department of Agriculture, and a card index for the publications of the State Experiment Stations.

**Withdrawal of Books**—Books may be drawn by all officers and students of the University. When not reserved for classes books may be borrowed for home use for two weeks, and may be renewed for two weeks more if not otherwise needed for University work. Books reserved for classes may be borrowed from the Library only at the hour for closing the reading room. They must then be returned within the first hour of the next opening of the Library. Books from the stacks which are not returned on time are subject to a fine of five cents a day. Books from the reserve shelves are subject to a fine of ten cents for the first hour and five cents for each additional hour if kept overtime. Books recalled for University work must be returned at once upon receipt of the notice. If not returned within two days after notice is mailed a fine of ten cents a day is charged.

**Hours**—The Library is open twelve hours on week days during the academic year, with the exception of Fridays and Saturdays, when a somewhat shorter schedule is observed.

**Correspondence and Loans**—Reference work for teachers and students throughout the State is gladly undertaken by correspondence. Loans of books will also be made to teachers and others engaged in systematic study in so far as the grant is not precluded by their need for resident use.

**Course in Bibliography**—The Librarian offers a general course in the use of books, elementary bibliography, and library administration, open to all students. In connection with this course the University Library issued in 1916 an *Annotated Shakespeare Booklist for the Arizona High Schools*.

### Museum

At the opening of the school year in September, 1915, the collections in the University of Arizona Museum were placed in the new Agriculture Building. This is practically a fire-proof structure, and insures the protection and safeguarding of the property of the University Museum until such time as the institution can secure a museum building.

A large room on the second floor has been set aside as a Natural History Museum and contains the valuable Herbert

Brown Collection of Arizona Birds, a collection of sixty specimens of reptiles and a few fossil remains of prehistoric animals. The bird collection comprises some 1600 specimens of **bird skins, 1000 birds' eggs and 100 birds' nests.** Practically all were taken in Arizona and comprise a very valuable educational exhibit on the bird-life of the State.

The collection of rocks and minerals has been placed temporarily in the main corridor near the Natural History Room and comprises several hundred specimens of fine ores and minerals from the mines of Arizona.

The archaeological and ethnological collections are arranged in a large room on the third floor of the same building. They consist of several hundred specimens representing the culture of the ancient cave and cliff people of the State, including fine illustrations of their baskets, sandals, cloth, pottery, jewelry, domestic utensils, agricultural implements, weapons, and ceremonial paraphernalia. The most of this material was obtained by the University Archaeological Expedition that worked in the canyons in the northern part of the State last summer. The director of the Museum expects to take a party of investigators into the "Cliff Dwellers" region again the coming summer to continue the work of exploration and excavation on the Navajo Indian reservation. By continuing this field work, the University hopes to save the evidences of the prehistoric culture still remaining in the State and build up its museum collections to represent adequately the complete life history of the various periods of the State's development.

Several hundred ethnological specimens represent the arts and customs of living Indian tribes and readily provide opportunity for the comparative study of the life of the prehistoric and the historic Indians. Special attention is being paid to the tribes living in Arizona. They are the most advanced and the most intelligent of the North American tribes of today and give most promise of becoming respectable productive citizens. The gift from Governor Geo. W. P. Hunt of a fine collection of Apache Indian baskets, and the loan from Mr. Perry Merrill Williams, of Maricopa, of 300 carefully selected Pima and Papago baskets have given an excellent start to the ethnological collections of the State University, and it is hoped, now that the University has suitable quarters in which to display such material, that the people will take pride in sending to the State Museum such relics as may come into their hands from time to time rather than send them to some museum outside of the State. They belong here in the environment in which they were

produced and where they will be accessible to the students and people of the commonwealth.

The Museum is open each afternoon, except Sunday, from two to five o'clock, and the public are invited to examine its collections.

## EQUIPMENT OF THE COLLEGE OF AGRICULTURE

### **Agricultural Chemistry**

The student laboratory for soil chemistry and soil physics is located on the second floor of the new Agriculture Building. Equipment for the study of the physical and chemical properties, and for the mechanical analysis of soils is provided. A store room well stocked with apparatus is connected with the laboratory.

The chemical laboratories of the Agricultural Experiment Station located on the first floor of the Agriculture Building embrace a commodious suite of eight rooms especially designed to meet the needs of the Department. The two main laboratories, one for routine Station work, and one for research, are connected by the balance room and a constant temperature dark-room. These laboratories are well equipped for general agricultural analytical work, being provided with polariscope, oxygen bomb calorimeter, electrolytic table, and other special apparatus. The nitrogen room is well isolated from the laboratories by an intervening office and is fireproof. A large work room for the preparation of samples is provided with electric power, suitable tables, mills, and a Buchner press. This room and the two large laboratories communicate directly with the store room, which, conveniently, has been made the center of the suite. Office room is also provided for the chemist and assistants.

The Experiment Station laboratories are open to graduate students and to undergraduates who are prepared to take up the investigation of special problems under the direction of the chemist.

### **Agronomy**

The Department of Agronomy occupies four rooms on the third floor of the Agriculture Building, which give ample space for all class and laboratory instruction. The laboratories are equipped with running water, waste facilities, gas, and light. In addition to these facilities there is an abundance of

class demonstrative material, germinating ovens, seed testers, microscopes, and lenses. A very complete library on agronomic subjects is at the disposal of the students. Numerous periodicals are also on the files of the department for student use. The department is fully equipped with necessary apparatus to carry on work along soil bacteriological lines under laboratory and class instruction.

In addition to the class room and laboratory facilities the department has under its supervision three dry farms, located respectively at Cochise, Prescott, and Snowflake, and three irrigated farms, located respectively near Tucson, in the Salt River Valley at Mesa, and at Yuma. These farms offer opportunities for students to study actual farming operations under various conditions, give means for carrying on demonstrations for their instruction, and furnish abundant class and laboratory material for grain judging and study of varieties.

The farm at Tucson is particularly useful for class instruction in that it is situated near the University with which it is connected by automobile service for the convenience of instructors and students. The tract is irrigated from a reinforced concrete well fitted with a 15 H. P. distillate engine and a No. 5 Krogh centrifugal pump. The distributing system consists of a 12-inch cement tile. The operation of this plant affords opportunity for the student to get first-hand information in the installation and operation of modern pumping machinery. The other farms are not so readily accessible, but are visited on special occasions and offer excellent opportunities for students given employment thereon to gain practical experience during their summer vacations.

### **Animal Husbandry**

The equipment of this Department consists of live stock, buildings, laboratories, and an excellent herd-book library. The University herd contains a number of registered cattle of the Hereford, Holstein-Friesian, Jersey and Ayrshire breeds, and a variety of grade cows. Good specimens of pure-bred Shropshire and Tunis sheep, and Duroc-Jersey swine, are maintained. All the animals, including poultry, are used by the classes in stock judging. In addition to the animals maintained by the University, there are some excellent stock farms within easy access of Tucson. The class in advanced stock judging attends the Annual State Fair at Phoenix, in charge of instructors. Additional facilities for instruction consist of charts, lantern slides, various instruments for measuring and studying stock,



specimens of feeding stuffs, wools and other animal products. Special instruments, medical appliances, charts, models, and preparations are available for instruction in veterinary anatomy and physiology, and in the diseases of live stock.

The Dairy Laboratory is situated in the south wing of the first floor of the new Agriculture Building, and is well equipped for instruction and investigation. Opportunities are given for milk testing, care in bottling of sanitary milk, butter-making, cheese-making, ice cream-making, dairy mechanics, and the preparation of special fermented milk products. Many of the best types of cream separators are installed, and all other necessary facilities for a thorough laboratory course in the principles and practice of dairying are provided.

The poultry equipment occupies five acres of land on the University Campus. Pure-bred specimens of many of the best breeds for the Southwest are maintained. Special conveniences are used for attending to the birds, and for incubating and brooding chicks. A flock of ostriches is a novel and attractive feature of this plant.

### **Horticulture**

The Department of Horticulture occupies a floor space of 2700 square feet on the second floor of the Agriculture Building. The space includes a large class room, a student laboratory, a research laboratory, a store room, the office of the horticulturist, and the office of the assistant horticulturist. The student laboratory is well equipped with microscopes, seed-testers, glassware, running water, gas, and other facilities which are necessary for the scientific study of horticulture.

Greenhouse space will be available for laboratory work in plant propagation and vegetable gardening. An orchard of one acre and a garden of one-half acre on the Campus prove valuable laboratories for horticultural students. These will be supplemented by an additional orchard and vineyard to be planted on the University Farm. The gardens adjacent to the city, two nurseries, and ranch orchards, afford additional places for study by students.

For students who are specializing in horticulture frequent trips will be arranged to visit and study practical horticultural work at the different sub-stations, and those sections of the State in which certain special cultures are highly developed. For such trips the following are within easy reach: (a) Thirty acres of the new farm at Mesa devoted to horticultural demonstration and experimentation. (b) The date orchards at



Tempe and Yuma where several hundred varieties of dates are being grown and successfully marketed on a commercial scale. (c) The large citrus industries of the Salt River Valley and the extensive olive orchards being developed particularly in the vicinity of Casa Grande.

### **Plant Breeding**

The Department of Plant Breeding occupies a well equipped class room and laboratory in the new Agriculture Building. As aids to instruction a large series of colored charts, lantern slides, and herbarium material are available. Much use is also made of material drawn from the operations of the Department of Plant Breeding in the Experiment Station. Here work in the practical breeding of corn, wheat, dates, beans, and other crops, furnishes ample material for laboratory and field practice in the study of variation, hybridization methods, selection and fixation of types. Greenhouse space is available for the forcing of plants to be hand-pollinated in winter, and during the warmer season a garden covered with screen wire furnishes a place protected from insects where cultures requiring close fertilization or cross fertilization by hand, may be carried on in the open without the inconvenience of special plant cages or the bagging of the individual flower clusters.

## **EQUIPMENT OF THE COLLEGE OF LETTERS, ARTS, AND SCIENCES**

### **Art**

For use in the courses in the history of painting, a good collection of standard reference books is available in the University Library, together with appropriate maps; also a large number of foreign photographs, Seeman colored reproductions, and Elson prints. Recently a representative collection of plaster casts has been acquired, to be used in teaching the influence of sculpture on painting.

### **Astronomy**

For astronomy an 8-inch Clark lens and mounting, both of the finest quality, loaned to the University by the Observatory of Harvard University, Cambridge, Mass., are erected on a cement pier supported on the main walls of the Science Building, and give perfectly steady images. This lens is most efficient in fundamental research work. The equipment also includes a four and one-quarter inch Brashear telescope, be-

longing to the University, sidereal and mean time clocks, and pier for latitude and longitude observation.

In order to obtain continuous records of the sun's heat falling upon this region, the department has a Callendar Sunshine Receiver connected to a Leeds and Northrup recording galvanometer. This mechanism has been running since October 9, 1913. For correcting its results a Smithsonian Silver Disk Pyrheliometer has been purchased.

### **Biology**

The biological laboratories occupy a convenient and well lighted suite of eight rooms, and have equipment suited to modern instruction and research in the biological sciences, to the region, and to the courses offered.

The herbarium consists of 50,000 mounted specimens, of which 20,000 sheets are in the Arizona botanical survey collection. There are also 6000 sheets in the herbarium of cultivated plants. The building up of these collections is progressing rapidly, largely by virtue of the work on the botanical survey of the State, which is being conducted by the Department of Biology, and which will result ultimately in the publication of a Flora of Arizona. The unique flora and fauna of the mountains, foothills, mesa, and river valley collecting grounds, in close proximity to the institution, offer attractive opportunities for instruction and research, particularly along taxonomic and ecological lines.

There are articulate and inarticulate skeletons, plaster and papier mache models of the more important structures of the human anatomy, and duplicate material for study and dissection. The department has twenty-six compound microscopes of Spencer, Bausch and Lomb, and Leitz types, a Leitz binocular microscope, Leitz rotary microtome, photographic apparatus, stereopticon, electric thermostats, centrifuge, spirometer, caloriscopes, electric apparatus including inductorium and rheocord for animal physiology, and also apparatus for plant physiology.

The Desert Botanical Laboratory of the Carnegie Institution located at Tucson is an inspiration for research work in the department and supplements the facilities of the University for botanical investigation, particularly as concerns field plant physiology and plant geography.

### **Chemistry**

The chemical equipment used for instruction occupies fourteen rooms in Science Hall.

The laboratory used for the study of general chemistry and qualitative analysis accommodates eighty students. It is equipped with the ordinary apparatus for this class of work, including a ventilating system of individual down-draft hoods.

The laboratory for quantitative analysis is equipped for the teaching of gravimetric, volumetric, and gasometric analysis, including metallurgical chemistry. The balance room contains fourteen analytic balances of the latest models so arranged as to insure a maximum of stability and accuracy. This room also contains such reference works loaned from the central Library as are useful in connection with the laboratory work.

A lecture and demonstration room fitted with a projection lantern, charts, and special apparatus used in the illustration of the principles of theoretical and practical chemistry, accommodates about eighty students.

The laboratory of physical chemistry is equipped with the following apparatus: Wanner's optical pyrometer, le Chateliers pyrometer, boiling point and freezing point apparatus, Pulfrich refractometer, Abbe refractometer, large wave length spectroscope made by Adam Hilger, thermostats, polariscope, and apparatus for conductivity work and the determination of electro-motive force.

One small laboratory is equipped for electro analysis, another for general electric furnace work, and a third for organic synthetic chemistry. The equipment for electric furnace work consists of both arc and resistance furnaces, transformers and motor-generators, vacuum pump for use with vacuum furnaces, and complete outfit for the thermal analysis of metals and alloys. This room is also furnished with gas muffle and crucible furnaces which find use in connection with the work in inorganic preparations.

Two offices and two private laboratories complete the equipment of the department.

The laboratories and equipment offer good facilities for original research and the department encourages such work for those having the necessary preparation.

### **Home Economics**

The south wing of the third floor in Agriculture Hall has been planned for the Department of Home Economics. The three large laboratories, one for cooking and dietetics, the other two for dressmaking and millinery, are well lighted and adequately equipped. Each sewing laboratory has a large

locker and supply room. The pantry of the cookery laboratory is well furnished and convenient. A model kitchen, butler's pantry, dining room, and bed room are provided. In these home-like rooms all household processes, the cooking and serving of meals, the cleaning and decorating of rooms, and the care of the sick and convalescent, are discussed and carried out.

### **Military Science and Tactics**

An armory is fitted with the necessary gun racks and accessories. The equipment includes one hundred and twenty-five Krag cadet rifles with complete accoutrements, six model 1906 Springfield chambered for .22 for indoor practice, twelve sabres and belts, musical instruments for the band, signal flags, eighteen new Springfield rifles, and targets for short range practice.

Annual encampment is held at a location approved by University authorities. The mess outfit is provided by the University and the meals of cadets while in camp are under the direction of the University Quartermaster.

### **Music**

Music Hall is equipped with studios for instruction in voice, piano, and stringed and wind instruments. Practice rooms are to be found off the Campus.

### **Physics**

The Department of Physics has facilities for the demonstration of all important phenomena. A lecture room seating forty persons is fitted with lights, water, gas, heliostat, alternating and direct current of great range, an opaque projection lantern, elevated seats, and shutters for darkening the room. Two large main laboratory rooms supply space for mechanical and electrical work, while special rooms are devoted to heat, sound, light, magnetism, and research work. A carpenter's shop, a repair and store room, a photographic dark and enlarging room, a constant-temperature room are provided. A pendulum seismograph is to be installed in the magnetic laboratory and a special space has been provided for a 55-foot Foucault pendulum and the study of falling bodies.

An eight-inch Willyoung induction coil with storage and X-ray accessories is used in the study of high-tension electricity. There are also a large Oudin resonator and a mercury interrupter, manufactured by Cox, and a Tesla coil of the Elster and Geitel type. Through the generosity of the Hon.



Mark J. Egan, of Clifton, the University has a fine imported set of miniature wireless telegraphy apparatus, capable of transmitting messages about two hundred feet. The department possesses also a Knott wireless outfit of  $\frac{1}{4}$ -kilowatt power, capable of sending messages about twenty-five miles; three motor generator sets, the largest having an output of 7 kilowatts; a Leeds and Northrup potentiometer and accessories; a Carey Foster low resistance bridge; a Leeds and Northrup recording galvanometer and bridge with various resistance thermometer bulbs; and very complete apparatus for showing electro magnetic phenomena, rotary fields, and stationary electric waves, polarization, etc.

### **Physical Training**

Gymnasium—Herring Hall, the Gymnasium, is well supplied with standard apparatus such as chestweights, dumbbells, barbells, wands, Indian clubs, Medart vaulting horse, parallel bars, horizontal bar, quarter-circle, abdominal chair, wrestling machine, finger machine, chest expander, chest developer, climbing rope, flying rings, traveling rings, striking bag and drum, jumping and vaulting stands, fencing foils and masks, basket balls and goals, five large mats, and a set of anthropometric apparatus. In the basement are one hundred and forty-four lockers, and five shower baths supplied with hot water from a heater with a large reservoir.

Outdoor Equipment—The outdoor equipment consists of two baseball fields; a quarter-mile track with a 120-yard straightaway; five tennis courts; a football field, and a basketball court for girls. A new athletic field of six acres, adjoining the gymnasium, was completed this year. A concrete open air swimming pool 100 feet long, 40 feet wide, and from three to seven feet deep, will be ready for use in September.

## **EQUIPMENT OF THE COLLEGE OF MINES AND ENGINEERING**

Commodious quarters for all departments of the College of Mines and Engineering will be provided in the new Mines and Engineering Building.

### **Architectural Engineering**

The classes in architectural engineering use the same quarters and equipment as the classes in civil engineering, and all of the equipment of the Department of Civil Engineering



is available for the use of students in architectural engineering. In particular, good recitation and drafting rooms are provided, there is a collection of lantern slides relating particularly to architectural subjects, and the University Library contains a considerable amount of good material upon architecture.

### **Civil Engineering**

The present quarters of the Department of Civil Engineering are in Science Hall and include an instrument room, an office, a materials testing laboratory, and a drafting room.

The surveying instruments include six transits, four levels, two plane tables, two compasses, a sextant, a considerable number of small instruments, and other equipment required for field work.

The materials testing laboratory is fitted for making physical tests of wood, iron, steel, stone, cement, concrete, and other materials used in engineering construction. The apparatus includes an Olsen 100,000-pound universal testing machine, a 3-gang abrasion cylinder, a tensile testing machine, briquette molds, cube molds, molds for concrete beams, molds for specimens for testing shearing strength of concrete, a Vicat needle machine, specific gravity flasks, sieves, moist chamber, immersion tanks for cement and concrete specimens, and other auxiliary equipment.

### **Electrical Engineering**

The present laboratory is equipped with a 50 kv.a alternator, a 23 kw. Crocker-Wheeler direct current generator, a 20 kv.a revolving field alternator, a 7 kw. direct current Fort Wayne generator, a 15-horsepower General Electric induction motor, a 15-horsepower Wagner variable speed induction motor, two Westinghouse 5-horsepower induction motors, a 5-horsepower single phase induction motor, a 1-horsepower Westinghouse three phase induction motor, a 5 kw. Fort Wayne rotary converter, a 3-horsepower direct current motor, a 5-horsepower Fort Wayne direct current motor, a 3 kw. Edison direct current bipolar generator, a 2-horsepower Wagner direct current motor, a 7 kw. Westinghouse direct current generator, a 5 kv.a. Packard variable voltage transformer, three 5 kv.a. auto transformers, a 110-23000 volt Thoradson transformer, a Tesla coil for high frequency and high voltage experimental work, a Leeds and Northrup potentiometer with volt-box and standard resistance, two current transformers, a graphic recording

ammeter, several integrating wattmeters, a series of indicating meters, switch and plug boards, necessary cables and wires for distributing current, electrical fittings, insulating materials, etc.

## **Geology**

The Department of Geology at present occupies three rooms in the Library building, a lecture and drawing room, a laboratory containing drawers for rock and ore specimens, and an office. The laboratory possesses a set of the geological folios and topographical maps published by the United State Geological Survey, and a series of rocks and ores supplemented by the collection in the Museum. The equipment further includes a Nachet polarizing microscope, a Leitz metallographic outfit for the study of polished surfaces or ores; a complete outfit for field work, with transit, plane tables, and alidades, as well as barometers, pocket transits, telometer, and pocket levels. The equipment of this laboratory is supplemented by that of Mineralogy and Petrology, Petrography, Mining, and Metallurgy.

**Field Work**—Opportunity is provided by the Departments of Mining, Metallurgy, and Geology for extensive field work during the academic year. An excursion of from one to two weeks is taken in the spring to one of the important mining and metallurgical districts of Arizona, New Mexico, or Sonora, and it is planned to make the overland trip to the Grand Canyon by way of the Petrified Forest, Painted Desert, and Northern Arizona Volcanic Field, taken during the spring of 1916, a biennial feature of the class in Field Geology. In addition, for Seniors and special students in mining, frequent trips of one or two days in the vicinity of Tucson are made possible by a grouping of all day laboratory periods in Mining, Metallurgy, and Geology, toward the latter part of the week.

Briefly, the region consists of deformed Paleozoic and Mesozoic sedimentary rocks, resting on a basement of pre-Cambrian shists and granites, intruded by late Mesozoic or early Tertiary volcanics. The mountains consist of maturely eroded fault blocks, separated by wide, partly waste-filled valleys, which increase in size toward the southwest. Thus, many varied features of geology and physiography are presented, as well as several types of ore deposits, consisting of contact metamorphic deposits, in the Twin Buttes and Silver Bell districts, veins and replacements in connection with the intrusive granitic rocks in the Santa Rita and Patagonia Mountains, and veins in the late Tertiary volcanics in the Mammoth

district and Tucson Mountains. In the immediate vicinity of Tucson, there are several old mines, formerly large producers, and a great number of smaller mines affording opportunity to study a great variety of mine development and mining methods. There are several concentrating mills in the region and two copper smelters in the vicinity.

### **Mechanic Arts**

The present shops and drafting rooms occupy a floor area of about 8000 square feet, and comprise a large shop and machinery room, with tool, supply, and store rooms adjacent; and draughting, model, pattern, and lecture rooms, and an office.

The wood shop has a full assortment of hand tools, twenty-four benches with a complete set of tools for each, six turning lathes, a Beach scroll saw, a Tannewitz dimension sawing machine, a band saw, a Universal trimmer, and a large grindstone with a truing device.

The forge-room contains twenty down-draught forges, twenty anvils, a Tate-Jones hardening furnace, a combination shear and punch, a blacksmith's drill press, a portable Ox-weld oxy-acetylene cutting and welding outfit, and a full assortment of tools and appliances. Blast is furnished by a No. 3 Sturtevant blower, and the smoke and gases are removed by a 70-inch exhaust fan.

The machine shop is equipped with a 24-inch Lodge and Shipley engine lathe with taper attachment, two 14-inch Lodge and Shipley lathes, a 14-inch Pratt and Whitney lathe with taper attachment, a 12-inch Seneca Falls lathe with taper attachment and provided with draw-in chuck and English and metric change gears, a 10-inch Reed speed lathe, a 16-inch Cincinnati shaper, a 24-inch by 6-foot Woodward and Powel planer, a Brown and Sharp No. 2 Universal milling machine, a Brown and Sharp No. 1 Universal grinder, a Prentice 24-inch drill press, a 13-inch Slate sensitive drill, a power hack-saw, a drill grinder, an emery stand, a grinding attachment for lathes, a 1½-ton portable hoist, a 1-ton triplex hoist, and a ½-ton screw hoist.

Each shop is provided with its own tool room for small tools, gauges, and measuring instruments.

### **Mechanical Engineering.**

The present laboratory is equipped for study and experimental work in the operation of steam boilers, steam and gas

engines, and hydraulic machinery. Besides the machinery of the Shops and Departments of Mining Engineering and Metallurgy, which are available for the study of machine design as well as for experimental work, the University has a 75-horsepower, internal furnace, marine-type boiler; a 45-horsepower, return tubular boiler; a 35-horsepower Atlas center-crank engine; a Chuse high-speed automatic side-crank engine directly connected to a 50 kv.a alternator; a 30-horsepower Fort Scott engine; a 10x7x10 Worthington duplex direct acting steam pump; a small duplex pump; a small Cameron boiler-feed pump; a 4-in. centrifugal pump; a 3½-in. two-stage centrifugal pump; a 6-in. Venturi meter; a 40-horsepower Fairbanks-Morse gasoline engine directly connected to a 500-gallon, high-pressure fire pump; and an injector. An 8x10 triplex pump with its electric motor serves as part of the equipment of the laboratory, and furnishes the University with its water supply. The department is also equipped with steam indicators, gauges and weighing scales, apparatus for testing fuels and flue gases, a large collection of models, machine parts, valves, abrasives, and a comprehensive catalogue file containing the trade literature of about five hundred of the leading manufacturers of this country. A large steel box overflowing into a cement cistern, and connected by suitable piping to the various pumps is provided for the testing of pumping machinery.

### **Metallurgy**

The present Mill or Metallurgical Laboratory tests the adaptability of ores for treatment by different processes, both on large and small scales.

Included in the equipment are a Blake crusher, 4-in. by 7-in.; a Dodge crusher, 4-in. by 6-in.; sampling rolls, 6-in. by 9-in.; a cone and burr sample grinder; a pebble mill with a capacity of about 15 lbs. at one charge; a laboratory lighting crusher and a disc pulverizer; a 5-stamp mill, with 800 pound stamps; a 3-stamp mill, with 250-pound stamps; inside and outside amalgamation plates for the same; a 00 McCulley gyratory crusher; a 2-ft. clean-up pan; a 1-ft. amalgamation pan; a 9-jar revolving agitator for testing samples of a few ounces; a No. 5 Wilfley table; a Hallet hand jig; a Richard's pulsator jig; a Richard's pulsator classifier; an international dry concentrator; a 1½ ton cyanide plant for treating sands or dry crushed ore; two 150-lb. cyanide plants for treating smaller samples; a 3-ft. agitator; a 12-in. 6-chamber, flush plate and frame, washing filter press and pump for the same; a Sturte-



vant shaking screen; a Tullock ore feeder; a belt and bucket elevator; and sampling plates, split samplers, a shaking screen, percolators, sizing screens from 1-mesh to 200-mesh, miners' pans, bateas, retorts, etc.

A very useful feature of the equipment is a Callow Miniature Plant. This consists of a small, two-compartment Hart jig, a small Wilfley table, a canvas slime table, an amalgamating plate, a set of hydraulic classifiers, set of cyanide agitators, and an automatic feeder. The plant is driven by a  $\frac{1}{8}$  H. P. motor, and stands on a hopper-bottom tank divided into three compartments. It is a complete ore dressing plant, a gold mill, and, together with the cyanide percolators described elsewhere, a cyanide mill. It handles quantities of ore ranging from twenty-five to four hundred pounds. The results obtained from tests on this outfit approximate closely to those secured in a full-size plant.

The Flotation Laboratory is equipped with two flotation machines of the latest type, one a modified Hoover 3-cell machine and the other a Janney machine. These are equipped for the use of either air or mechanical agitation, and are especially well adapted for testing work. The Flotation Laboratory is in a separate room, which is also equipped for testing oils.

In the Assay Laboratory there are assay furnaces for crucible work, for scorifying and cupeling, and for retorting mercury from amalgam. These are fired with coke, gasoline, and gas; so the student secures training in the use of all these fuels. In addition, are provided all necessary appliances for assaying by dry and wet methods, and desks and fittings for the chemical work required in the metallurgical and mineralogical investigation and analysis of ores.

The power for operating the plant is furnished by a 30 H. P. Westinghouse induction motor, type C.

### **Mineralogy and Petrology**

The present laboratories are equipped with all necessary minerals, apparatus and reagents for teaching blowpipe analysis; a type collection of minerals aggregating over six hundred specimens, classified according to Dana; supplementary collections illustrating the physical properties of minerals; a type collection of rocks numbering several hundred pieces; three hundred pasteboard, and numerous glass and wooden models of crystals; several two-circle contact goniometers; and a large and rapidly growing working collection of minerals and rocks. The display collection of minerals and rocks in the



Museum, and a portion of the equipment of the Departments of Geology and Optical Mineralogy are also available for the use of students in this department.

### Optical Mineralogy and Petrography

The laboratory contains seven petrographic microscopes including both American and foreign makes, a Zeiss binocular for opaque work, models for illustrating axes of elasticity and spherical projection, a type set of rocks classified according to Rosenbusch's *Elemente der Gesteinlehre* with thin sections corresponding, one hundred and twenty oriented sections of minerals, and apparatus for photomicrography and projection. For the study of crystal measurement, there are several two-circle contact goniometers and one two-circle reflecting Goldschmidt goniometer, apparatus for projection and drawing of crystals, and a model machine for cutting crystals from plaster of Paris.

### Mining Engineering

The present laboratory for the practical study of Mining Engineering is attached to the Mill building.

The equipment includes an assortment of hand and machine tools, and all apparatus for testing purposes; a WG 3 8x8 Sullivan belt-driven compressor, with 30x6 pressure tank; a FF12 Sullivan 2½ Lite Weight drill with tripod; a DC19 jack hammer drill, Sullivan type; a Waugh drifting drill; a Chicago stoper; a 40G Cleveland stoper; a No. 1 Model V Murphy block-hold drill; a 2½-in. Pacific rock drill, with clamp and column; a 3-in. Leyner Model 5 slugger, with tripod; a 4E Temple-Ingersoll electric air drill, with clamp and column; a 2½-in. Wood drill, with clamp and column; a McKiernan-Terry jack hammer drill; a double inlet Sirocco fan; a model Connellsville involute blower; a 3½-in. Acme blower; a 12-in. Typhoon blower; a large assortment of steel and hose of various kinds and makes; and candlesticks, lighting devices, and miners' lamps of many types.

Pumping and drainage are illustrated by a 6x24 Fernier sand pump; a Cameron model pump; a 4-in. type EE American centrifugal pump; a 5½x2½x3 Blake pump; a 1-in. Class O Buffalo centrifugal pump; a model Connellsville cycloidal pump; a 3x2x3 Dow steam pump; an Edison 8-ft. trench pump; a type N Kingsford centrifugal pump; a 2-in. Krogh vertical centrifugal pump; and a 5¼x3½x5 Worthington steam pump.

The sharpening department is equipped with a Buffalo forge and a No. 3 Leyner oil forge, and an anvil and a complete assortment of tools.

The timber framing department is supplied with tools, and with a large number of models illustrating the use of timber underground, as well as the construction of head frames, ore bins, etc., above ground.

The College of Mines and Engineering is so advantageously located, as far as proximity to operating mines is concerned, that much of the laboratory work can be carried on in the field. The opportunity thus enjoyed to examine and study large scale installations and operations is utilized in preference to small scale laboratory work whenever this is possible.

## STUDENT RESPONSIBILITIES AND ACCOMMODATIONS

**Student Body Organization**—The students are organized under the title, The Student Body Organization, for the purpose of carrying on all student enterprises with the cooperation and under the supervision of a faculty committee. The organization has a carefully drawn constitution, a President, Vice-President, Secretary, and Treasurer. Much of the business of the organization is carried on in a House of Representatives which meets twice a month and to which two faculty members belong. The funds of the organization are kept in the hands of the Financial Secretary of the University.

**Discipline**—The policy of the University in all its departments is based upon the assumption that students come to the institution with a determination to utilize the opportunities offered, and with a keen sense of duty, honor, and courtesy to each other and to the faculty.

**Dormitories**—Provision is made so far as possible for furnishing board and rooms to students of both sexes upon the University grounds. Young men have comfortable quarters in South Hall, accommodating about sixty-five students, two in a room, and in Arizona Hall, accommodating forty students; Pima Hall and West Cottage provide accommodations for forty young women, under competent supervision. All dormitories are lighted by electricity. Rooms contain a clothes press, single beds, tables, chairs, mirror. Students supply their own sheets, blankets, towels, rugs, brooms, laundry bags, and such articles as they may desire for ornamenting their rooms.

They care for their own rooms under the direction of the head of each dormitory.

Residence Off the Campus—The residence of students off the Campus so far as these students are not living in their own homes, is subject to the approval of the University authorities.

The Dining Hall—The Dining Hall of the University is under the management of a trained dietician who is responsible to the President and the Board of Regents. It is the aim of the University to serve substantial, wholesome, appetizing meals at cost. All students having rooms in the dormitories are required to take their meals at the Dining Hall. Students and members of the faculty who reside outside of the dormitories may board at the Dining Hall with permission of the President. Board is payable in advance on the first of each month.

## EXPENSES AND FEES

Tuition—The University of Arizona requires no general tuition fee of students who are legal residents of the State of Arizona, and there is no charge for instruction except for some courses in the Department of Music. Students who are non-residents of the State pay a tuition fee of \$15 each semester. A non-resident is (1) a minor whose parents or guardians are not residents of Arizona; (2) a student of legal majority who comes to Arizona without the intention of making this state his home. Students from Spanish-American countries and from Belgium are by courtesy exempt from tuition.

Incidental Fee—An incidental fee of \$10 is payable annually by all students on the day of registration, \$5 of which is credited by the University to the Student Activities Fund. On the incidental fee there is no rebate if for any reason a student is compelled to leave the University, the amounts collected having already been either expended in cost of registration or distributed to the individual student enterprises. But students entering at the opening of the second semester are required to pay only \$5 of this incidental fee.

Board—Board on the Campus is charged for at the rate of \$20 per month, payable in advance on the first day of each month.

Rooms—Rooms in the dormitories of the institution are double rooms, costing each student \$12.50 each semester, pay-

able in advance at the time of registration. No portion of this amount is rebated, except in case of withdrawal from the institution.

**Cadets' Uniforms**—Members of the cadet companies are required to provide themselves with the prescribed uniforms.

**Encampment Expense**—The cadets will also pay the cost of their transportation to the annual encampment amounting to about \$5. Students who are members of the cadet companies and do not live on the campus are charged \$4 for their board during the period of encampment.

**Laboratory Fees**—In certain laboratory courses deposits are required as security for the payment of the cost of breakage and material supplied. A statement of the amount of such deposits may be found in connection with the announcement of courses. Any balances remaining in these funds are returned to the students upon the completion of such courses.

Checks and postoffice or express money orders should be made payable to the University of Arizona.

## ASSISTANCE TO STUDENTS

**Self-Support**—Various positions about the grounds, buildings, and laboratories of the University, paying from \$4 to \$20 per month, are filled by students who must be self-supporting. The number, however, is not large, and preference is given to students from Arizona and to those who have spent time enough in the University to demonstrate that they are earnest, capable, reliable young men, able to do this outside work and at the same time maintain a good record as students.

**The Students' Loan Fund**—The Students' Loan Fund gives temporary assistance to deserving students, men or women. The conditions under which loans are made may be ascertained on inquiry of the President of the University.

## SCHOLARSHIPS

**County Scholarship**—By Act of the Legislature a scholarship in the University is granted to each county of the State, to be assigned to that student who passes the best examination set by the University. The examination is under the supervision of the County School Superintendent and is held in the month of June. The papers are read at the University, the President certifies the results to the County Superintendent and to the successful candidate.

Candidates for county scholarships are examined upon the following subjects: English, algebra, science (either agriculture, botany, zoology, physics, chemistry, or physical geography); and two other subjects (chosen from history, Latin, French, German, Spanish, or a second science). The examination is restricted to five subjects.

The scholarship amounts to \$150 a year and is payable by the State direct to the University, to be applied on the student's bill for board, room, incidental, and other fees.

The scholarship is good for one year at the University and is to be held during the student's Freshman year. When a county offers no candidate for the Freshman class, a candidate for admission to a higher class in the institution may apply for the qualifying examination and if successful, secure the scholarship.

The Bennett Scholarship—The Philo Sherman Bennett scholarship is endowed by the gift of \$500 to the University in 1905, through the agency of Mrs. William Jennings Bryan, the income to be used in aiding young women to secure an education.

The Collegiate Club Scholarship—The Collegiate Club of Tucson has for several years given a scholarship stipend of \$50 to aid in the education of some young woman recommended by a committee of faculty members of the Collegiate Club.

The State Federation of Clubs Scholarship—The State Federation of Clubs not infrequently makes a University student the beneficiary of one of its scholarships.

#### **BUREAU OF RECOMMENDATION**

The University of Arizona maintains a Bureau of Recommendations for the purpose of helping deserving students and graduates who have received their training at the University of Arizona, to secure desirable positions, and of leading employers to find well prepared and efficient workers. No registration fee is charged, and the bureau, without expense to the candidate, forwards to those interested in his application confidential information which it has collected concerning him. All students desiring to register with the bureau will consult the Chairman.



# ADMISSION

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## GENERAL REQUIREMENTS APPLYING TO ALL NEW STUDENTS

Age—All applicants for admission to the University must be at least sixteen years of age.

Character—All new students are required to furnish satisfactory evidence of good character, and certificate of graduation or of honorable dismissal from the school last attended.

Health—All new students at the time of registration shall submit a statement, signed by a reputable physician, certifying to good health or to such disability as will in any way affect the student's University work or his membership in the University.

### REQUIREMENTS FOR ADMISSION TO FRESHMAN RANK

All applicants for admission to Freshman rank in the University are expected to have completed the equivalent of a four-year high school course including the work indicated by the fifteen credits specified below:

English .....	3	Physics, Chemistry, or Bi-	
Algebra .....	1½	ology .....	1
Plane Geometry .....	1	Latin, Greek, French, Ger-	
History and Civics.....	1	man, or Spanish .....	2
		Electives .....	5½

A credit is understood to stand for one study pursued satisfactorily five times a week for one year.

All departments of the University require fifteen credits for admission.

All departments excepting the College of Agriculture require the distribution of credits called for above. This college differs from the other departments in its requirements in one point only. For admission to the four-year course in agriculture, a student may substitute two elective units for the two years of a foreign language. Such a student is, however, required to take two years of a foreign language instead of one for graduation from the University.

## SCOPE OF THE ADMISSION REQUIREMENTS

**English**

English—3 credits. (a) English Composition. The candidate should have the ability to express himself in writing clearly and consecutively. No candidate will be accepted whose work is notably defective in point of neatness, spelling, punctuation, idiom, or division into paragraphs. (b) English Classics. The classics to be studied in preparation for college English are divided into two classes, those intended for thorough study and those intended for general reading. Preparation in the former class should cover subject matter, form, and structure, and the leading facts in those periods of English literary history to which the prescribed books belong. In the latter class, the student should secure general knowledge of the subject matter, and of the lives of the authors. In exceptional cases an equivalent amount of reading and study in other than prescribed works will be accepted as a substitute.

For thorough study for 1917 Shakespeare's *Macbeth*, Milton's *Comus*, *L'Allegro*, and *Il Penseroso*; Burke's *Speech on Conciliation with America*, or Washington's *Farewell Address*, and Webster's *First Bunker Hill Oration*; Macaulay's *Life of Johnson* or Carlyle's *Essay on Burns*.

For general reading and practice, selections will be made, at the discretion of the teacher from groups I-IV of College Entrance Requirements in English for 1915-1919.

**Mathematics**

Algebra— $1\frac{1}{2}$  credits. The work required in algebra covers the usual fundamental subjects, and extends through quadratic equations, graphical representation of equations, proportions, etc., as given in standard texts, such as Hawkes, Luby and Touton, *Complete School Algebra*, or Slaught and Lennes.

Plane Geometry—1 credit for a year of work. The requirement is based upon the work outlined in text-books such as Wentworth and Smith's *Geometry*, with special reference to original exercises and notebook work.

Solid Geometry— $\frac{1}{2}$  credit for a half year of work. Original exercises and notebook work are required.

**History**

To meet the requirements in history the student should have acquired a knowledge of events as presented in any of the standard text-books. There is required further an interpretation and analysis of these events, which includes an understand-

ing of the causes and results of any movement, and an appreciation of the various influences acting in the development of an institution.

Ancient History, to the year 800 A. D.—1 credit.

Mediaeval and Modern History of Europe—1 credit.

History of England—1 credit.

History and Government of the United States—1 credit.

## Languages

\*Greek—2 credits. As covered by Gleason and Atherton's *Beginner's Greek Book*; Xenophon's *Anabasis*, four books; Homer's *Iliad*, three books, with composition and the use of Hadley and Allen's or Goodwin's *Greek Grammar*.

\*Latin—2, 3, or 4 credits. As covered by Collar's *First Latin Book* and *Viri Romae*, together with Allen and Greenough's *Grammar* and texts; Cæsar, four books, or an equivalent; Cicero, four orations; Virgil, six books; sight reading from Nepos, Cicero, and Gellius; Daniell's or Bennett's *Prose Composition*.

\*German—2 credits. Two years of high school work to cover the following texts or their equivalent: P. V. Bacon's *German Grammar*, Storm's *Immensee*, von Hillern's *Hoher als die Kirche*, Meyer-Foerster's *Karl Heinrich*, Schiller's *Wilhelm Tell*.

\*French—2 credits. Two years of high school work, covering the following texts, or an equivalent: Frazer and Squair, *French Grammar*, (Part 1), with additional drill on the irregular verbs; Aldrich and Foster, *French Reader*; Allen and Schoell, *French Life*, Halévy, *L'Abbé Constantin*; Merimeé, *Colomba*; Lamartine, *Graziella*.

\*Spanish—2 credits. Two years of high school work, covering the following texts, or an equivalent: De Vitis, *Spanish Grammar*; Turrell, *Spanish Reader*; Alarcón, *El Capitán Veneno*; Galdós, *Marianela*; Valdés, *La Hermana San Sulpicio* or *La Alegría del Capitán Ribot*; Valera, *Pépita Jiménez*.

## Science

Physical Geography—1 credit or ½ credit. A year or half-year of work should include the principles of the subject, as

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\*The courses offered should include the texts named, or an equivalent. Two years of one language must be presented, but one or more years of a second language will be accepted as elective.

treated in the best recent text-books, field, and laboratory study, and the interpretation and steady use of topographic and weather maps and charts. The subject may be combined in half-credits with physiology, which may in its turn be offered as a full credit if it is so desired.

Botany—1 credit or  $\frac{1}{2}$  credit. The course should cover a study of the life histories of types from the main groups of plants, and a series of simple physiological experiments. At least two-thirds of the course should consist of laboratory work. Botany as a half-credit may be combined with a half-credit in zoology for a full credit or year's work in biology.

Chemistry—1 credit. A year's course of descriptive chemistry, consisting of both class-room and laboratory work, should include the more common metals and non-metals, and their compounds. A careful record of laboratory experiments should be kept.

Physics—1 credit. Along with the use of one of the standard text-books the year's course should include continuous and systematic laboratory practice, recorded in a notebook.

### Electives

The electives offered for admission should be chosen from the subjects named above or any other subjects ordinarily taught in high schools and accepted by colleges and universities of standing, with the following restrictions:

Credit to the extent of one unit each may be allowed in, music, freehand drawing, mechanical drawing, shop work, home economics, stenography, typewriting, and bookkeeping, or two units may be allowed for stenography including typewriting. Credits in other subjects may be presented for the consideration of the Registration Committee.

### METHODS AND CONDITIONS OF ADMISSION TO FRESHMAN RANK

Admission on Certificate—The University admits without examination graduates of approved high schools of Arizona, presenting certificates showing them to have completed satisfactorily the courses prescribed for admission on page 49 in this catalogue. They are the high schools of Bisbee, Clifton, Douglas, Glendale, Globe, Jerome, Mesa, Morenci, Nogales, Phoenix, Prescott, Tempe, Thatcher, Tucson, Willcox, Winslow, Yuma. The Florence High School, the Tombstone High School, and the academies at Snowflake and St. Johns, are

accredited for such a part of the preparatory work as they give. The normal schools at Tempe and Flagstaff are among the fully accredited schools. Diplomas or corresponding credentials from high schools and preparatory schools in other states, accredited by the state universities of such states, will excuse from examinations in subjects covered by such credentials.

**Admission by Examination**—Students lacking satisfactory credentials will be examined on the work required for admission, on the first two days set aside for registration. Application for such examinations should be made at least two weeks before the date for the entrance examinations.

**Admission with Deficiency in Preparation**—A student deficient in two units of the work required for admission will be accepted as a conditioned Freshman.

**Time of Removal of Entrance Deficiencies**—All entrance deficiencies must be removed not later than the beginning of the Junior year. Such deficiencies as are not met by that time will be satisfied where possible by cancellation of such college units as may be necessary to satisfy the entrance requirements.

**Manner of Removal of Entrance Deficiencies**—An entrance deficiency may be removed by examination, or if the deficiency is in other than required work, by transfer of college credit to entrance credit on the basis of six units of college work, three hours a week for a year, to one entrance credit, five hours a week for a year.

### **ADMISSION TO ADVANCED STANDING**

**From Other Colleges**—Students coming from other institutions of recognized standing are admitted to classes above Freshman upon the presentation of properly authenticated certificates of work done, and when so admitted will be credited in the records of this University with so much of such work as corresponds approximately with the courses required for the desired degree here. No degree will be granted to any student for less than 20 units of resident work, distributed through not less than two semesters. Certificates of record should be accompanied by statements of honorable dismissal or leave of absence, and a copy of the register or catalogue showing the content of the credits certified.

**Entrance Requirements of Students Admitted to Advanced Standing from Institutions of Equivalent Rank**—Students who have had one or more years of work at an institution of equiva-



lent rank to the University of Arizona and who have satisfied the entrance requirements of that institution will be given full entrance standing.

**Credit for High School Work in Excess of Entrance Requirements**—Advance credit is not allowed for excess preparation gained in high school, unless such excess represents equivalent work given in the University. Students having an excess of two years of one foreign language in an accredited high school may receive credit for one year of college work in that subject, without examination.

A student having a credit in Trigonometry not used for entrance, may, upon passing a satisfactory examination in that subject, receive two units credit in college mathematics.

**Admission from Arizona Normal Schools**—Graduates of the two-year and five-year courses in the Tempe and Flagstaff Normal Schools, are given a total credit of 30 units in the University, which shall not cancel requirements in English 1, 2.

#### **ADMISSION OF SPECIAL STUDENTS**

Students over twenty-one years of age, who have not met the entrance requirements, may be admitted to the University as special students, and may elect, with the consent of the instructor in charge, such courses as they are prepared to carry with profit. A special student, twenty-five years of age, may, by permission of the faculty, become a candidate for a degree, subject to the fulfillment of such requirements regarding entrance work as may be determined by the faculty.

It is expected that those who desire thus to specialize in Mineralogy, Assaying, Geology, or Surveying, will have had at least a high school education, or its equivalent, particularly in English, algebra, geometry, physics, and chemistry.

#### **ADMISSION OF UNCLASSIFIED STUDENTS**

Students over twenty-one years of age, who have met the entrance requirements, but who do not wish to become candidates for a degree, are, upon presentation of a satisfactory written statement of reasons for taking special work, admitted to the University as unclassified students. Students who are not yet twenty-one years of age, who have met the entrance requirements, are admitted as unclassified students only when the request to pursue a special course is accompanied by the written approval of parent or guardian.

## REGISTRATION

**Qualifications**—All facilities and privileges of the University are open to properly qualified persons of both sexes. The qualifications in age, character, health, and scholarship required for registration are stated on page 49.

**Time and place**—All students are required to register on registration days at the beginning of the year and at the beginning of the second semester, in the University office or in such rooms as may be designated for the purpose.

**Penalty for Late Registration**—For late registration a fee of \$1 will be charged for the first day, and twenty-five cents for each day thereafter, until a maximum of \$2 is reached.

**Presentation of Credentials**—Students entering from other institutions should present to the Registrar certified copies of their records in such schools, together with certificates of graduation or of honorable dismissal, and a copy of the school catalogue or course of study in order to facilitate registration.

**Fees**—An incidental fee of \$10 is payable annually by all students on the day of registration. For other fees and deposits payable at the opening of the year see page 46.

**Certificates of Registration**—Each student must obtain from the Registrar's office a Certificate of Registration indicating that fees have been paid and that the student is entitled to enroll in class work.

**Study Cards**—Students in the Freshman and Sophomore years, select with the advice of the Dean of the College in which they register the courses for the ensuing semester and enscribe them on a Study Card. The Study Card, bearing the signature of the Dean, should then be submitted to the Registrar for inspection, and after that signed by each instructor with whom work is to be taken. The Study Card thus made out, approved, and signed, must be filed with the Registrar not later than three days after the date of registration.

For students in the Junior and Senior years, the method of procedure is the same, except that the Study Card is filled out with the advice of the head of the department in which the student's major subject is chosen, signed by him, and countersigned by the Dean.

**Required Subjects**—All male students are required to register for Military Tactics for the first four semesters of college work.

Physical training is required for women throughout the Freshman and Sophomore years.

Each student must register for the required subjects of his course in so far as possible in the year for which they are prescribed. English 1, 2, is required of Freshmen. For the specific requirements of the several courses leading to degrees, see outlined courses of study, pages 62-74.

Elective Subjects—Entering students may not elect work in excess of the number of units recommended in the course for which they register. Petitions to elect work in excess of number of units recommended in the course for which a student registers, will be considered only when presented by students whose capacity for work has been demonstrated to the satisfaction of the faculty.

Change of Registration—Registration may be changed within ten days of entrance into the University by obtaining the proper card from the Registrar, and securing thereon the signatures of both instructors concerned, and that of the Dean. In the case of Juniors and Seniors it must also bear the approval of the head of the department in which the student's major is taken.

Registration may not be changed after the expiration of the ten days' limit, except after investigation and approval by the Registration Committee.

## GENERAL REGULATIONS AFFECT- ING REGISTERED STUDENTS

**Attendance**—A student having registered for a course, is required to attend all resulting appointments regularly. Any student who is absent three times from one class is automatically suspended from that class, and when his absences from all classes reach twelve, he is suspended from all University work. Absences from a class during neglected suspension from that class, count towards this total.

**Excuses**—Excuses for absence during a stated length of time may be secured beforehand by presenting a petition to the Dean of the College in which the student is registered or to the President. The petition having been approved by the Dean or the President, is filed with the Registrar.

**Reinstatement** — Students automatically dropped from classes or University under the ruling stated above may apply for reinstatement by filing with the Registrar a petition for such reinstatement, together with the approval of the Dean or the President and the instructors concerned. Such petition shall state in writing the circumstances of the absence.

**Absence before and after Holidays**—Students absent without excuse on the day before or after holidays will not be permitted to take the regular examination at the end of the semester, but must take special examinations later; and in laboratory courses such students will be recorded as incomplete at the close of the semester.

**Withdrawal from Courses**—To withdraw from a course during a semester a Freshman or Sophomore must secure the approval of his instructor and the Dean of his College, and deposit with the Registrar the official withdrawal card properly signed by the instructor and the Dean concerned. A Junior or Senior must further secure the approval and signature of the head of the department in which his major is taken. For such a withdrawal, made at least six weeks before the close of the semester, the grade W shall be entered on the records.

**Dismissal from Courses**—After conference with the President and the Dean of the College in which the student is registered, an instructor may, at any time, dismiss a student from a course. Written notice of such action, signed by the Dean and the instructor interested, should be sent immediately to

the Registrar. Such a dismissal is considered a failure and is indicated on the records by the grade X.

Grades—The grades given are A, excellent; B, good; C, medium; C—, barely passing; D, a failure that may be removed by extra-class requirement or examination only at the time set for condition examinations; X, a failure that can be removed only by repeating the course; I, incomplete, because of illness or other accepted reasons, a deficiency that may be made up at the convenience of the instructor; W, approved withdrawal.

Eighty per cent of the work done for a degree must be above the grade C—.

Only one attempt to remove a D condition by examination or extra-class work is permitted. Such a condition must be removed before the repetition of the course in which it has been obtained, and if not so made up, automatically becomes X, necessitating the repetition of the course.

Continuance in College—All students shall be required to carry with a grading above D, at least 50 per cent of the work for which they are registered. Students who are unable to do so shall be barred from class privileges for one semester. Such students may be granted a card of honorable dismissal, in which a statement regarding deficiency in work shall be expressly included. Students coming from other institutions of similar standing with dismissals of this kind will be required to give continued evidence of ability to carry successfully the work in the courses which they elect.

Eligibility to Student Activities—A student must be carrying at least ten units of work to be eligible for any regular student activity. Any student failing (that is receiving a D, I, or X) in 25 per cent or more of the hours for which he is registered in a given semester, shall be debarred from holding any office in the Student Body Organization, or in any student organization of the University, and from representing the University or any organization of the University in any athletic contest, until such time as these deficiencies shall be removed and assurance given by the instructors concerned that at least 75 per cent of such student's work is of passing grade. The Committee on Delinquent Students with the approval of the President, shall have authority to debar any student from holding such offices or so representing the University whenever instructors shall report delinquencies in 25 per cent of such student's registration; notice of such action will be sent to the student and to the members of the House of Representatives.



Classification—A student to have Sophomore standing must have obtained 20 units of college credit, and must have fulfilled the entrance requirements.

A student to have Junior standing must have obtained 55 units of college credit, and must have fulfilled the entrance requirements.

Classification is based upon the number of units credited at the beginning of the school year.

Petitions—Students or classes desiring to make requests of the faculty should file their petitions in the President's office before the hour of faculty meeting; class petitions must be presented at least two days before the time of meeting.

# DEGREES

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## THE BACHELOR'S DEGREE

**General Statement**—The University offers four-year courses of literary and scientific study leading to the degrees of Bachelor of Arts and Bachelor of Science, and four-year courses of more technical study leading to the degrees of Bachelor of Law and Bachelor of Science in some specified field: Agriculture, Commerce, Chemistry, Architectural, Civil, Electrical, or Mechanical Engineering, or Mining Engineering and Metallurgy. Great latitude of election is given in literary and scientific courses, but the technical courses are more rigid in their requirements. No degree is granted to any student for less than 20 units of resident work, distributed through at least two semesters.

**The Unit System**—Credit toward degrees is given by means of a unit system which assigns to each course of instruction offered a certain number of units or credits. A unit usually represents one hour of class-room work a week for a semester, and assumes three hours of application; it may stand for one hour of class-room work and two hours of preparation, or for three hours of laboratory work, or for such distribution as the particular course may demand.

**Number of Units Required for Degrees**—The number of units required for graduation varies with the course chosen:

In the courses leading to the degrees, Bachelor of Arts, Bachelor of Science, Bachelor of Laws, Bachelor of Science in Agriculture, and Bachelor of Science in Commerce, 124 units, including four units in Military Tactics for men and four units in Physical Training for women, will be required of students entering after the year 1914-1915. Candidates for these degrees graduating in 1917, will, however, be required to have completed 127 units.

In courses leading to the degrees, Bachelor of Science in Chemistry, Bachelor of Science in Architectural Engineering, Bachelor of Science in Civil Engineering, Bachelor of Science in Electrical Engineering, Bachelor of Science in Mechanical Engineering, Bachelor of Science in Mining Engineering and Metallurgy, the requirement for graduation will be 144 units, including four units in Military Tactics for men and four

units of Physical Training for women for students entering later than 1914-15.

**Thesis**—Any candidate for a Bachelor's degree may present as part fulfillment of requirements for graduation an acceptable Thesis embodying the result of a special study of some subject within the range of the course pursued. The subject and the credit value of the Thesis not to exceed four units, are to be approved by the head of the department in which the Thesis is taken, and the Registration Committee. The completed Thesis must be presented not later than three weeks before the Commencement Day.

**Grouping of Subjects**—For convenience in outlining courses the various subjects taught in the University are grouped as follows:

Group I. English Composition and Rhetoric, English Literature.

Group II. Latin, Greek.

Group III. Spanish, French, German.

Group IV. History and Archaeology, Social Science, Philosophy and Psychology, Education, Law, History of Art, History of Music.

Group V. Military Tactics, Physical Training.

Group VI. Astronomy, Botany, Chemistry, Geology, Mathematics, Mineralogy, Physics, Zoology, Bacteriology.

Group VII. Agriculture, Home Economics, Mechanic Arts, Military Science, Engineering, Metallurgy.

#### **REQUIREMENTS FOR THE DEGREES OF BACHELOR OF ARTS AND BACHELOR OF SCIENCE**

The candidates for the degrees of Bachelor of Arts and Bachelor of Science are allowed a large measure of freedom in choice of work, but to safeguard them from choosing too narrow and highly centralized courses, and at the same time to secure reasonable concentration, they are subject to the following restrictions:

No candidate for the degree of Bachelor of Arts or Bachelor of Science may take over fifty units in one department.

Every candidate for the degree of Bachelor of Arts or Bachelor of Science must elect and file with the Registrar before April the first of the Sophomore year, a major subject in which he must take from 24 to 40 units, including the thesis, if a thesis is offered. The work on the major subject must be dis-

tributed through five semesters. A student may change his major at the beginning of any semester by filing a petition with the Registrar, approved by the heads of both departments concerned, and countersigned by the Dean of the College in which the student is registered.

All candidates for the degree of Bachelor of Arts or Bachelor of Science must take the courses prescribed and distribute a number of their electives in accordance with the outlines given below:

#### REQUIREMENTS FOR THE DEGREE OF BACHELOR OF ARTS

*Group I (English) .....	16 units, including 1, 2, 3, 4, 5, 6
Group II or III (Foreign Language).....	16 units, one subject
Group IV (History, Philosophy, etc.)....	8 units, one subject
Group V (Mil. Drill or Phys. Tr.) .....	4 units, one subject
Group VI (Science) .....	8 units, one subject
	—
	52 units, required
	72 units elective

The elective major ranging from 24 to 40 units may lie wholly within the 72 electives or be included, in part, in the 52 required units.

With permission of the faculty two related subjects may be combined to form a major.

#### REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE

Group I (English) .....	10 units, including 1, 2
Group III (Modern Language) .....	16 units, one subject
Group IV (History, Philosophy, etc.)....	8 units, one subject
Group V (Mil. Drill or Phys. Tr.) .....	4 units, one subject
Group VI (Science) .....	24 units, including 8 units in Mathematics and 16 units in not more than two subjects.
	—
	62 units required
	62 units elective

The elective major ranging from 24 to 40 units may lie wholly within the 62 electives or be included, in part, in the 62 required units.

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\*The groups are given on page 61.

### SUGGESTED COURSES FOR DEGREE OF BACHELOR OF SCIENCE WITH MAJOR IN HOME ECONOMICS

Candidates for the degree of Bachelor of Science who wish to make Home Economics a major subject are advised to elect their work in accordance with one or the other of the courses outlined below:

#### COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE WITH MAJOR IN FOODS AND COOKERY

##### FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 .....	3	English 2 .....	3
Mathematics 9 .....	4	Mathematics 10 .....	4
Chemistry 1 .....	4	Chemistry 2 .....	4
Modern Language .....	4	Modern Language .....	4
Physical Training .....	1	Physical Training .....	1
	<hr/> 16		<hr/> 16

##### SECOND YEAR

English 3 .....	2	English 4 .....	2
Modern Language .....	4	Modern Language .....	4
Chemistry 23 .....	4	Chemistry 3 .....	4
H. E. 1 (Foods and Cookery) ....	3	H. E. 2 (Food and Cookery) ....	3
Physical Training .....	1	Physical Training .....	1
*Elective .....	2	Elective .....	2
	<hr/> 16		<hr/> 16

##### THIRD YEAR

Zoology 4 (Physiology) .....	4	Zoology 5 (Physiology) .....	4
Bacteriology .....	1	Drawing 11 .....	2
Drawing 11 .....	2	History of Education .....	4
History of Education .....	4	H. E. 4 (Food Economics) .....	3
H. E. 3 (Food Economics) .....	3	Chemistry of Foods .....	2
Elective .....	2		
	<hr/> 16		<hr/> 15

##### FOURTH YEAR

H. E. 11 (Theory and practice of Teaching Foods and Cookery) 2		H. E. 12 (Theory and Practice of Teaching Foods and Cookery) 2	
H. E. 9 (House Planning, Furnishing and Decoration) .....	2	H. E. 10 (House Planning, Furnishing and Decoration) .....	2
H. E. 7 (Dietetics) .....	3	H. E. 8 (Dietetics) .....	3
Electives .....	8	Electives .....	7
	<hr/> 15		<hr/> 14

Total, 124 units

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\*H. E. 13 and 14 (Elementary Clothing and Hand Work), H. E. 17 (Drafting, Draping, and Pattern Making), H. E. 22 and 23 (Millinery), Landscape Gardening, History of Art, and Psychology, are recommended electives.



COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
WITH MAJOR IN TEXTILES AND CLOTHING

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 .....	3	English 2 .....	3
H. E. 13 (Elementary Clothing) 3	3	H. E. 14 (Elementary Clothing) 3	3
Drawing 11 .....	2	Drawing 11 .....	2
Mathematics 9 .....	4	Mathematics 10 .....	4
Modern Language .....	4	Modern Language .....	4
Physical Training .....	1	Physical Training .....	1
	<hr/> 17		<hr/> 17

SECOND YEAR

English 3 .....	2	English 4 .....	2
Modern Language .....	4	Modern Language .....	4
*Science Group VI .....	4	*Science Group VI .....	4
H. E. 15 (History of Costume and Costume Design) .....	3	H. E. 16 (History of Costume and Costume Design) .....	3
Physical Training .....	1	H. E. 17 (Drafting, Draping, and Pattern Making) .....	2
Bacteriology .....	1	Physical Training .....	1
	<hr/> 15		<hr/> 16

THIRD YEAR

H. E. 18 (Dressmaking) .....	2	H. E. 19 (Dressmaking) .....	2
H. E. 22 (Millinery) .....	2	H. E. 23 (Millinery) .....	2
Zoology 4 (Physiology) .....	4	Zoology 5 (Physiology) .....	4
Education 1 .....	4	Education 2 .....	4
†Electives .....	3	H. E. 24 (Textiles) .....	3
	<hr/> 15		<hr/> 15

FOURTH YEAR

H. E. 20 (Advanced Dressmak- ing) .....	2	H. E. 21 (Advanced Dressmaking) 2	2
H. E. 19 (House Furnishing, Planning and Decoration) .....	2	H. E. 26 (Theory and Practice of Teaching Textiles and Clothing) .....	2
H. E. 25 (Theory and Practice of Teaching Textiles and Clothing) .....	2	Electives .....	10
Electives .....	9		
	<hr/> 15		<hr/> 14

Total, 124 units

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\*Chemistry, Botany, Physics, or Astronomy suggested. See requirements for B. S. degree.

†H. E. 21 (Advanced Dressmaking), H. E. 1 and 2 (Foods and Cookery), History of Art, Landscape Gardening, Social Science 2, and Psychology are recommended electives.

## REQUIREMENTS FOR DEGREE OF BACHELOR OF LAWS

*Group 1 (English) .....	10 units, including 1, 2, 3, 4
Group II III (Foreign Languages)....	8 units, one subject
Group IV (History, Philosophy, etc.)	8 units, subject other than Law
Group V (Mil. Drill or Phys. Tr.)	4 units, one subject

—  
30 units, Group I, II or III, IV, V  
72 units, Department of Law  
22 units, Free Electives

Total, 124 units

COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
IN AGRICULTURE

Subjects required of all students in this course, with assigned units.

English 1, 2 .....	6	Agronomy 1 or Horticulture 1....	3
Mathematics 1 .....	5	Agronomy 3 .....	3
Military Tactics .....	4	Animal Husbandry 1 .....	3
Mechanic Arts 1 or 10 .....	2	Animal Husbandry 11 .....	4
Chemistry 1, 2 .....	8	Animal Husbandry 8 or Plant	
Physics 1, 2 .....	8	Breeding 1 .....	3
Biology 1 .....	4	Agricultural Chemistry 1 .....	4
Botany 3 .....	4	Agricultural Chemistry 2 .....	4
Social Science 1, 2 .....	6	—	24
†Foreign Language .....	16		
—	63	Agricultural Group Electives	
		(not less than 16 units in one	
		group) .....	30
		Free Electives .....	17

Total, 124 units

## AGRICULTURAL GROUP ELECTIVES

- Group I Agronomy. Horticulture 2, 3; Agronomy 2, 4, 5; Chemistry 3, 23.  
Group II Horticulture. Horticulture 2, 3, 4, 5, 6, 7, 8; Agronomy 4; Botany 11, 14.  
Group III Animal Husbandry. Animal Husbandry 2, 3, 4, 5, 6, 7, 9, 10, 12; Botany 10.  
Group IV Agricultural Chemistry. Chemistry 3, 23, 7, 8, 9, 10; Food Chemistry.  
Group V Biology. Botany 2, 3, 5, 10, 11, 12, 13; Bacteriology; Zoology 3, 4, 5, 6, 8, 9, 10.  
Group VI Rural Engineering. Students electing a major in this group should take Mathematics 2, 3, 4, 5, as electives; Mechanic Arts 8, 9, 11; Mechanical Engineering 1, 2, 3, 4, 12, 14; Civil Engineering 1, 2, 6, 11, 13, 14a, 14b, 15, 19, 20a, 20b, 22; Electrical Engineering 1, 9.  
Group VII Rural Economics and Administration. Civil Engineering 15; Social Science 4a, 9, 12, 13, 18; English 3, 4, 21, 22, 25; Law 3 or 6 units.

\*Groups are given on page 61.

†Required of students not offering two units in foreign language for entrance; others are required to take one year only.

The following four-year schedule is offered for the guidance of the student, and is advisory only. It may be varied to meet the individual needs, but elementary sciences should be taken early and attention given to prerequisites for the advanced courses.

FIRST YEAR			
FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 or Mod. Lang. ....	3 or 4	English 2 or Mod. Lang. ....	3 or 4
Biology 1 or Chemistry 1 ....	4	Botany 3 or Chemistry 2 ....	4
Mathematics 1 .....	5	Agr. Group Electives .....	3 to 7
Animal Husbandry 1, or Horticulture 1, or Agr. Group Elective .....	3	Agronomy 1, .....	3
Military Tactics 1 .....	1	Mechanic Arts 10 .....	2
		Military Tactics 2 .....	1
	<hr/> 16		<hr/> 16

SECOND YEAR			
English 1 or Mod. Lang. or Free Elective .....	3 to 7	English 2 or Mod. Lang. or Free Elective .....	3 to 7
Biology 1 or Chemistry 1 ....	4	Botany 3 or Chemistry 2 ....	4
Agricultural Chemistry 1 or Agr. Group Electives .....	4 to 7	Agricultural Chemistry 2 ....	4
Military Tactics 3 .....	1	Agr. Group Electives .....	3 to 6
	<hr/> 16	Military Tactics 4 .....	1
			<hr/> 16

THIRD YEAR			
Mod. Lang. or Free Elective .....	4	Mod. Lang. or Free Elective .....	4
Physics 1 .....	4	Physics 2 .....	4
Animal Husbandry 8, or Agr. Group Electives .....	8	Plant Breeding 1, or Agr. Group Electives .....	8
	<hr/> 16		<hr/> 16

FOURTH YEAR			
Mod. Lang. or Free Elective .....	4	Mod. Lang. or Free Elective .....	4
Social Science 1 .....	3	Social Science 2 .....	3
Agronomy 3, or Agr. Group Electives .....	9	Animal Husbandry 11, or Agr. Group Electives .....	9
	<hr/> 16		<hr/> 16

Total, 124 units

#### TWO-YEAR SHORT COURSE IN AGRICULTURE

(Not Leading to a Degree)

Any student who has obtained 60 units of University credit of which 4 are in Military Tactics and not less than 40 units are in Agricultural Science, including Biology 1, Botany 3, Agronomy 1 or Horticulture 1, Animal Husbandry 1, and Agricultural Chemistry 1, is eligible to a certificate for having completed the short course in Agriculture. Any person holding a

short course certificate who has met the entrance requirements for the four-year course in Agriculture, shall have Junior rank. Students will be admitted to the Short Course who have general knowledge of the common school branches and sufficient maturity to understand the value of their time and opportunity.

### COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN ARCHITECTURAL ENGINEERING

#### FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition) .....	3	English 2 (Composition) .....	3
Foreign Language .....	4	Foreign Language .....	4
Math. 1 (Alg. & Trig.) .....	5	Math. 2 (Analytical Geom.) .....	4
Chem. 1 (General) .....	4	Chem. 2 (General) .....	4
Mech. Arts 1 (Eng. Draw.) .....	2	Mech. Arts 2 (Descrip. Geom.) ....	3
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 19		<hr/> 19

#### SECOND YEAR

Math. 3 (Diff. Cal.) .....	4	Math. 4 (Int. Cal.) .....	4
Physics 1 (General) .....	4	Physics 2 (General) .....	4
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
English 3 (Literature) .....	2	English 4 (Literature) .....	2
Civil Eng. 19 (Surveying) .....	2	Civil Eng. 20a (Surveying) .....	2
Arch. Eng. 1 (Arch. Draw.) .....	3	Arch. Eng. 2 (Design) .....	3
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	<hr/> 19		<hr/> 19

#### THIRD YEAR

Math. 5 (Theor. Mech.) .....	4	Math. 6 (Theor. Mech.) .....	4
Civil Eng. 11 (Hydraulics) .....	4	Civil Eng. 14a and b (Mech. of Mat.) .....	4
Arch. Eng. 3 (Design) .....	3	Arch. Eng. 4 (Design) .....	3
Arch. Eng. 5 (Hist. of Arch.) ....	2	Arch. Eng. 6 (Hist. of Arch.) ....	2
Arch. Eng. 7 (Working Draw.) ....	1	Arch. Eng. 8 (Working Draw.) ....	1
Elective .....	3	Elective .....	3
	<hr/> 17		<hr/> 17

#### FOURTH YEAR

Arch. Eng. 9 (Fire Proofing) ....	2	Arch. Eng. 10 (Office Bldgs.) ....	4
Civil Eng. 7 (Steel Mill Bldgs.) ..	4	Arch. Eng. 12 (Estimating) .....	2
Civil Eng. 15 (Contracts) .....	2	Civil Eng. 6 (Concrete Design) ....	4
Elec. Eng. 9 (General) .....	3	Elec. Eng. 3 (Lighting) .....	2
Mech. Eng. 18 (Plumbing) .....	1	Geology 18 (Geol. Bldg. Mats.) ..	2
Mech. Eng. 17 (Heat and Vent) ....	3	Elective .....	3
Elective .....	2		
	<hr/> 17		<hr/> 17

Total, 144 units

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN CHEMISTRY

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 .....	3	English 2 .....	3
Mathematics 1 .....	5	Mathematics 2 .....	4
German 1 or French 1 .....	4	German 2 or French 2 .....	4
Chemistry 1 .....	4	Chemistry 2 .....	4
Mech. Arts 1 .....	2	Mech. Arts 2 .....	3
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

English 3 .....	2	English 4 .....	2
Mathematics 3 .....	4	Mathematics 4 .....	4
German 3 or French 3 .....	4	German 4 or French 4 .....	4
Physics 1 .....	4	Physics 2 .....	4
Chemistry 23 .....	4	Chemistry 3 .....	4
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	<hr/> 19		<hr/> 19

## THIRD YEAR

Chemistry 4 .....	2	Chemistry 24, 25 .....	4
Chemistry 7 .....	4	Chemistry 8 .....	4
Geology 13 .....	2	Geology 14 .....	2
Mineralogy 1 .....	3	Chemistry 9 .....	2
Metallurgy 2 .....	2	Electives .....	5
Electives .....	4		
	<hr/> 17		<hr/> 17

## FOURTH YEAR

Metallurgy 11 .....	3	Metallurgy 12 .....	2
Chemistry 14 .....	2	Chemistry 15 .....	2
Thesis .....	2	Chemistry 10 .....	2
Electives .....	10	Thesis .....	2
		Electives .....	9
	<hr/> 17		<hr/> 17

Total, 144 units



# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN CIVIL ENGINEERING

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition) .....	3	English 2 (Composition) .....	3
Math. 1 (Alg. and Trig.) .....	5	Math. 2 (Analytics) .....	4
Mech. Arts 1 (Eng. Draw.) .....	2	Mech. Arts 2 (Descrip. Geom.) ....	3
Chem. 1 (General Chem.) .....	4	Chem. 2 (General Chem.) .....	4
Foreign Language .....	4	Foreign Language .....	4
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 19		<hr/> 19

## SECOND YEAR

Math. 3 (Diff. Cal.) .....	4	Math. 4 (Int. Cal.) .....	4
Physics 1 (General) .....	4	Physics 2 (General) .....	4
English 3 (Literature) .....	2	English 4 (Literature) .....	2
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
Civil Eng. 1 (Surveying) .....	3	Civil Eng. 2 (Surveying) .....	3
Military Tactics 3 .....	1	Military Tactics 4 .....	1
Elective .....	2	Elective .....	2
	<hr/> 19		<hr/> 19

## THIRD YEAR

Math. 5 (Theor. Mech.) .....	4	Math. 6 (Theor. Mech.) .....	4
Civil Eng. 11 (Hydraulics) .....	4	Civil Eng. 14a & b (Mech. of Mat.) .....	4
Elec. Eng. 9 (General) .....	3	Mech. Eng. 3 (Heat Engines) ....	3
Option 1:		Option 1:	
Geology 13 (Dynam. & Phys.) 2		Geology 16 (Eng. Geol.) .....	2
Electives .....	4	Electives .....	4
Option 2:		Option 2:	
Astronomy 3 (Eng. Ast.) .....	3	Physics 4 (Elect. & Opt. Meas.) 3	
Electives .....	3	Electives .....	3
	<hr/> 17		<hr/> 17

## FOURTH YEAR

Civil Eng. 7 (Steel Mill Bldgs.) 4	Civil Eng. 6 (Concrete Design) ....	4
Civil Eng. 9 (R. R. Eng.) .....	Civil Eng. 8 (Bridges) .....	4
Civil Eng. 13 (Irrigation) .....	Civil Eng. 10 (R. R. Eng.) .....	2
Civil Eng. 15 (Contracts) .....	Civil Eng. 18 (Sewerage) .....	3
Civil Eng. 17 (Water Supply) ....	Elective .....	4
Bacteriology .....		
Elective .....		
	<hr/> 17	<hr/> 17

Total, 144 units

# COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE IN COMMERCE

## FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 .....	3	English 2 .....	3
Foreign Language .....	4	Foreign Language .....	4
History 1 .....	3	History 2 .....	3
Social Science 1 .....	3	Social Science 2 .....	3
Accounting .....	2	Accounting 2 .....	2
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 16		<hr/> 16

## SECOND YEAR

Foreign Language .....	4	Foreign Language .....	4
Social Science 3 .....	4	Social Science 4 .....	4
Social Science 5 .....	3	Social Science 5a .....	3
Science or Mathematics .....	4	Science or Mathematics .....	4
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	<hr/> 16		<hr/> 16

## THIRD YEAR

Law or Social Science 7 .....	3	Law or Social Science 8 .....	3
English .....	2	English .....	2
History .....	3	History .....	3
Social Science 18 .....	3	Social Science .....	3
Electives .....	5	Electives .....	5
	<hr/> 16		<hr/> 16

## FOURTH YEAR

Social Science 9 .....	3	Social Science 10 .....	3
Social Science 15 or 16 .....	3	Social Science 12b .....	3
Social Science 12a .....	3	Law or Psychology .....	3
Law or Psychology .....	3	Electives .....	5
Elective .....	2		
	<hr/> 14		<hr/> 14

Total, 124 units

## THE TWO-YEAR COURSE IN COMMERCE (Not Leading to a Degree)

FIRST YEAR	UNITS	SECOND YEAR	UNITS
English 1, 2 .....	6	Spanish .....	8
Elementary Accounting .....	4	Commercial Law .....	6
Social Science 1, 2 .....	6	Social Science 5, 5a .....	6
Social Science 3, 4 .....	8	Social Science .....	6
History 1, 2 .....	6	Business Practice .....	6
Military Tactics 1, 2 .....	2	Military Tactics 3, 4 .....	2
	<hr/> 32		<hr/> 34

**COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
IN ELECTRICAL ENGINEERING**

**FIRST YEAR**

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition) .....	3	English 2 (Composition) .....	3
Math. 1 (Algebra and Trig.) ....	5	Math. 2 (Analytical Geom.) .....	4
Foreign Language .....	4	Foreign Language .....	4
Mech. Arts 1 (Eng. Draw.) .....	2	Mech. Arts 2 (Descript. Geom.) ..	3
Chemistry 1 (General) .....	4	Chemistry 2 (General) .....	4
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 19		<hr/> 19

**SECOND YEAR**

Math. 3 (Diff. Cal.) .....	4	Math. 4 (Int. Cal.) .....	4
Physics 1 (General) .....	4	Physics 2 (General) .....	4
English 3 (Literature) .....	2	English 4 (Literature) .....	2
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
Mech. Eng. 1 (Mechanisms) ....	3	Mech. Eng. 2 (Mach Draw.) ....	3
C. E. 19 (Surveying) .....	2	C. E. 20a (Surveying) .....	2
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	<hr/> 19		<hr/> 19

**THIRD YEAR**

Math. 5 (Theor. Mech.) .....	4	Math. 6 (Theor. Mech.) .....	4
Mech. Arts 5 (Mach. Shop) .....	2	Mech. Eng. 3 (Heat Engines) ....	3
Mech. Eng. 5 (Mach. Design.) ....	3	Mech. Eng. 15 (Elec. Mach. Design) .....	2
Elec. Eng. 9 (General) .....	3	Elec. Eng. 1 (Direct Current) ....	3
Civ. Eng. 11 (Hydraulics) .....	4	Civ. Eng. 14a & b (Mech. of Mat.) ..	4
Elective .....	2	Seminar .....	1
	<hr/> 18	Elective .....	1
			<hr/> 18

**FOURTH YEAR**

Mech. Eng. 7 (Mech. Lab.) .....	2	Mech. Eng. 8 (Mech. Lab.) .....	2
Elec. Eng. 7 (Design.) .....	3	Elec. Eng. 8 (Elec. Sta. Design.) ..	3
Elec. Eng. 5 (Lab.) .....	2	Elec. Eng. 6 (Lab.) .....	2
Elec. Eng. 2 (Alt. Current) .....	4	Elec. Eng. 3 (Illumination) .....	2
Seminar .....	1	Elec. Eng. 4 (Elec. Traction) ....	2
Elective .....	4	Mech. Eng. 12 (Power Plants) ..	2
	<hr/> 16	Elective .....	3
			<hr/> 16

Total, 144 units

COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
IN MECHANICAL ENGINEERING

FIRST YEAR

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition) .....	3	English 2 (Composition) .....	3
Math. 1 (Algebra and Trig.) ....	5	Math. 2 (Analytical Geom.) .....	4
Foreign Language .....	4	Foreign Language .....	4
Mech. Arts 1 (Eng. Draw.) .....	2	Mech. Arts 2 (Descript. Geom.)....	3
Chemistry 1 (General) .....	4	Chemistry 2 (General) .....	4
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	19		19

SECOND YEAR

Math. 3 (Diff. Cal.) .....	4	Math. 4 (Integral Cal.) .....	4
Physics 1 (General) .....	4	Physics 2 (General) .....	4
English 3 (Literature) .....	2	English 4 (Literature) .....	2
Mech. Arts 3 (Wood Shop, Foundry) .....	3	Mech. Arts 4 (Mach. Shop, Forge) .....	3
Mech. Eng. 1 (Mechanisms) .....	3	Mech. Eng. 2 (Mach. Draw.) .....	3
Civ. Eng. 19 (Surveying) .....	2	Civ. Eng. 20a (Surveying) .....	2
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	19		19

THIRD YEAR

Math. 5 (Theor. Mech.) .....	4	Math. 6 (Theor. Mech.) .....	4
Mech. Arts 5 (Mach. Shop) .....	2	Mech. Arts 6 (Mach. Shop) .....	2
Mech. Eng. 5 (Mach. Design.) ....	3	Mech. Eng. 6 (Mach. Design.) ....	3
Elec. Eng. 9 (General) .....	3	Mech. Eng. 3 (Heat Engines) ....	3
Civ. Eng. 11 (Hydraulics) .....	4	Civ. Eng. 14a & b (Mech. of Mat.)	4
Elective .....	2	Mech. Eng. 16 (Seminar) .....	1
	18	Elective .....	1
			18

FOURTH YEAR

Mech. Eng. 7 (Mech. Lab.) .....	3	Mech. Eng. 8 (Mech. Lab.) .....	3
Mech. Eng. 9 (Eng. Design.) ....	2	Mech. Eng. 10 (Engine Design.)	2
Mech. Eng. 11 (Adv. Heat Engines) .....	2	Mech. Eng. 12 (Power Plants) ....	2
Civ. Eng. 7 (Steel Mill Bldgs.)	4	Thesis (or Elective) .....	4
Mech. Eng. 13 (Seminar) .....	1	Electives .....	5
Elective .....	4		
	16		16

Total. 144 units

**COURSE LEADING TO THE DEGREE OF BACHELOR OF SCIENCE  
IN MINING ENGINEERING AND METALLURGY**

**FIRST YEAR**

FIRST SEMESTER	UNITS	SECOND SEMESTER	UNITS
English 1 (Composition) .....	3	English 2 (Composition) .....	3
Math. 1 (Alg. and Trig.) .....	5	Math. 2 (Analytics) .....	4
Mech. Arts 1 (Eng. Draw.) .....	2	Mech. Arts 2 (Descript. Geom.)..	3
Chem. 1 (General Chem.) .....	4	Chem. 2 (General Chem.) .....	4
Foreign Language .....	4	Foreign Language .....	4
Military Tactics 1 .....	1	Military Tactics 2 .....	1
	<hr/> 19		<hr/> 19

**SECOND YEAR**

Chem. 23 (Qual. Anal.) .....	4	Chem. 3 (Quan. Anal.) .....	4
Math. 3 (Diff. Cal.) .....	4	Math. 4 (Int. Cal.) .....	4
C. E. 1 (Surveying) .....	3	C. E. 2 (Mine Surveying) .....	3
Physics 1 (General) .....	4	Physics 2 (General) .....	4
Min. and Pet. 1 .....	3	Min. and Pet. 2 .....	3
(Cryst. and Blow-pipe Anal.)		(Determinative Mineralogy)	
Military Tactics 3 .....	1	Military Tactics 4 .....	1
	<hr/> 19		<hr/> 19

**THIRD YEAR**

English 3 (Literature) .....	2	English 4 (Literature) .....	2
Math. 5 (Anal. Mech.) .....	4	Math. 6 (Theor. Mech.) .....	4
Geol. 1 (General) .....	3	Geol. 2 (Struch. and Hist.) .....	3
Chem. 4 (Volumetric) .....	2	Chem. 24 (Met. Analysis) .....	2
Met. 2 (Assaying) .....	2	Min. and Pet. 4 (Petrology) .....	2
Min. 10 (Excavations) .....	3	C. E. 14a (Str. of Mat.) .....	3
M. E. 1a (Mechanisms) .....	1	Elective .....	2
	<hr/> 17		<hr/> 18

Six weeks' work in mine, mill, or smelter. No credit.

**FOURTH YEAR**

**Geology Option**

Geol. 3 (Econ. Geol.) .....	3	Geol. 4 (Econ. Geol.) .....	3
Met. 11 (Gen. & Cop. & Lead) ...	3	Met. 12 (Iron) .....	2
Met. 7 (Ore Dress.) .....	3	Min. 14 (Methods) .....	1
E. E. (Elect. Mach.) .....	2	Geol. 6 (Field Geol.) .....	3
Geol. 5 (Field Geol.) .....	3	Opt. Min. 6 (Petrography) .....	2
Opt. Min. 5 (Optical Miner) .....	2	C. E. 12 (Hydraulics) .....	2
Elective .....	1	Geol. 8 (Geol. N. Amer.) .....	2
	<hr/> 17	Elective .....	1
			<hr/> 16



## Mining Option

Geol. 3 (Econ. Geol.) .....	3	Met. 12 (Iron) .....	2
Met. 11 (Gen. & Cop. & Lead) ....	3	Met. 18 (Ore Dress. Lab.) .....	2
Met. 7 (Ore Dress.) .....	3	Min. 14 (Methods) .....	2
E. E. 9 (Elect. Mach.) .....	2	Min. 14a (Lab.) .....	3
Min. 13 (Machinery) .....	2	C. E. 12 (Hydraulics) .....	2
Geol. 5 (Field Geol.) .....	3	Met. 14 (Gold & Silver) .....	3
Elective .....	1	Min. 19 (Exam. & Reports) .....	1
		Elective .....	1
	<hr/>		<hr/>
	17		16

## Metallurgy Option

Geol. 3 (Econ. Geol.) .....	3	Met. 12 (Iron) .....	2
Met. 11 (Gen. & Cop. & Lead) ....	3	Met. 18 (Ore Dress. Lab.) .....	2
Met. 11a (Met. Lab.) .....	3	Min. 14 (Methods) .....	1
Met. 7 (Ore Dress.) .....	3	M. E. 3 (Heat Engines) .....	3
E. E. 9 (Elect. Mach.) .....	2	C. E. 12 (Hydraulics) .....	2
Min. 13 (Machinery) .....	2	Met. 14 (Gold & Silver) .....	3
Elective .....	1	Met. 16 (Electromet.) .....	2
		Elective .....	1
	<hr/>		<hr/>
	17		16

Total, 144 units

## ADVANCED DEGREES

Advanced degrees will be given only for work done in residence by students who have received the Bachelor's degree from this institution, or one of similar standing. Every candidate for an advanced degree must submit his course of study for the year, to the Committee on Graduate Study for approval, before November 15.

The Degree of Master of Arts and the Degree of Master of Science—For the degree of Master of Arts or Master of Science, 30 units of graduate work, of which not less than 15 units and not more than 22 must be in the major subject, are required. The thirty units required must include a Thesis, for which not more than 15 units of credit may be allowed. Candidates for these degrees are required to pass an oral examination, at which the members of the Committee on Graduate Study have the privilege of being present.

Mining Engineering—Students who expect to follow the profession of mining engineering are advised to take a fifth year, or a five-year course, since the four-year course allows insufficient time for a student to master all the subjects with which a mining engineer must be familiar in order to attain eminence in his profession.

Requirements for the Degree of Engineer of Mines—Undergraduate work: Candidates must have completed the course leading to the degree of Bachelor of Science in Mining Engineering and Metallurgy, as given by the University of Arizona, or the equivalent of this course in some school of recognized standing. Graduate work: The fifth year's course must consist of not less than thirty units of graduate work, and must include (1) all of the following courses, or their equivalents, which have not already been completed by the candidate: Geology 1, 2, 3, 4, 5, 6, 7; Mineralogy and Petrology 1-3, 2, 4; Optical Mineralogy 5, 6; Mining Engineering 10, 13, 14, 14a, 15 (or Metallurgy 10) 19, 21, (or Metallurgy 20); Metallurgy 2, 7, 10, (or Mining Engineering 21). (2) At least eight units of graduate work in Mineralogy, Optical Mineralogy, Geology, Mining Engineering, or Metallurgy. (3) Sufficient work in other departments of the University, preferably in engineering subjects, to make up a total of thirty units. Except in special cases, this work should not be of lower than Junior grade. (4) At least six weeks of work underground or in mills or smelters, together with a satisfactory detailed report on the same.

Graduate Assistants in the State Bureau of Mines—The University of Arizona has established in connection with the State Bureau of Mines a limited number of positions in which graduate assistants are employed. These pay approximately \$400 per academic year.

The Arizona Bureau of Mines is devoted to research and other forms of mining investigations, its purpose being the study of problems of especial interest to the mining and metallurgical industries of Arizona, and the dissemination of information which will tend toward the upbuilding of these activities.

The graduate assistants appointed agree to hold these positions during the academic year, and to devote one-half of their time to work in connection with the Bureau of Mines; the remaining time is devoted to graduate study in candidacy for advanced degrees.

Applications for such positions should be made to the University of Arizona, Tucson, Arizona.

# DESCRIPTION OF COURSES OF INSTRUCTION

1916-1917

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The number by which a course is designated is not intended to indicate the relative advancement of the course.

The faculty reserves the right to cancel any class when a suitable number of students fails to register for it.

A student must meet the prerequisites or otherwise satisfy the instructor in charge, of his ability to take a course for which he has registered.

For the hours of classes, the student is referred to the horarium issued at the opening of the college year.

## AGRICULTURAL CHEMISTRY

### 1. Soil Physics.

PROFESSOR VINSON AND ASSISTANT PROFESSOR CATLIN

Origin, composition, and classification of soils; soil temperature and conditions influencing it; soil texture and soil structure as related to tillage, moisture, and plant food; soil colloids and organic matter; various culture methods based on physical properties of soils; irrigation and drainage; mechanical analysis. Required of all students in agriculture. Three lectures and one three-hour laboratory period. First semester. Four units.

### 2. Soil Chemistry.

PROFESSOR VINSON AND ASSISTANT PROFESSOR CATLIN

Amount and availability of the various elements of plant food in soils; relation of humus to soil fertility; commercial fertilizers and their application; control of alkali; composition of irrigating waters; making and using farm manures; crop rotations; the Rothamstead experiments; theory of toxic substances in soils. Required of all students in agriculture. Lectures and laboratory work. Prerequisites, Chemistry 1, 2, and Agricultural Chemistry 1. Three lectures and one three-hour laboratory period. Second semester. Four units.

## AGRONOMY

PROFESSOR NICHOLSON AND MR. HEARD

## 1. Farm Crops.

MR. HEARD

A brief study of cereals and various other farm crops of the United States; a more detailed study of those that may be grown successfully in Arizona; commercial varieties, methods of culture, and market demands. Required, optionally with Horticulture 1, of all students in agriculture. Three hours. Second semester. Three units.

## 2. Dry Farming.

MR. HEARD

Rainfall and other climatic conditions in the various dry farming regions of the world; general dry farming methods; crops adapted to dry farming; dry farming methods and possibilities in Arizona. Review of bulletins dealing with experimental work; lectures and library work. Prerequisites, Agronomy 1 and Agricultural Chemistry 1. Three hours. First semester. Three units.

## 3. Farm Management.

PROFESSOR NICHOLSON

Purchase, organization, equipment, and management of farms with reference to financial returns; farm accounts, market demands, marketing associations; the farm lay-out, farm buildings, leveling for irrigation, location and management of ditches, are among the subjects to be discussed. Required of all students in agriculture. Two lectures and one three-hour laboratory period. First semester. Three units.

## 4. Soil Bacteriology.

PROFESSOR NICHOLSON

A study of the relationship of bacteria to soil fertility. The formation of humus, bacterial activity in manures, relationship of bacteria to nitrification, denitrification and nitrogen fixation, will be studied in this course. The use of bacteria in inoculating soils for legume growing, and the action of these organisms on the minerals in the soil will also be covered. Lectures and laboratory work. Prerequisites, Agricultural Chemistry 1 and 2 and Botany 1. Two lectures and two three-hour laboratory periods. First semester. Four units.

## 5. Agronomy Literature.

PROFESSOR NICHOLSON

Daily and weekly reports upon assigned readings in bulletins and standard works, to round out the student's knowledge of



the general field of agronomy, and to prepare the way for research in the subject. Open to Juniors and Seniors. First semester. Three units.

## ANIMAL HUSBANDRY

PROFESSOR WILLIAMS AND ASSISTANT PROFESSOR CUNNINGHAM

The Department of Animal Husbandry has an assortment of livestock at the University Farm, which is used for class work at the University. There is also poultry equipment, a new creamery, and complete set of herd books. These are used for class purposes.

### 1. Live Stock Judging.

PROFESSOR WILLIAMS, ASSISTANT PROFESSOR CUNNINGHAM

Judging different classes of horses, cattle, sheep, and swine. Use of the score card; practice in comparative judging. Animals from the University herd are used, supplemented by live stock belonging to neighboring ranchmen and farmers. Required of all students in agriculture. Two lectures and one three-hour demonstration. First semester. Three units.

### 2. Veterinary Physiology and Anatomy.

ASSISTANT PROFESSOR CUNNINGHAM

Special physiology and anatomy of farm animals. Lectures and recitations supplemented by practical experiments in the laboratory. Three hours. First semester. Three units.

### 3. Animal Diseases. ASSISTANT PROFESSOR CUNNINGHAM

(a) General and specific causes of diseases and methods of prevention; errors in feeding and in care of animals; sanitation of stables, feeding pens and pastures; preventive inoculation; tuberculin test and veterinary regulations; (b) diagnosis and treatment of common ailments of farm animals; (c) simple operations. Prerequisite, Animal Husbandry 2. Lectures, recitations, and clinics. Not offered in 1916-17, but offered in 1917-18. Three hours. Second semester. Three units.

### 4. Poultry Husbandry.

PROFESSOR WILLIAMS

General care and management of poultry, including the production of eggs and poultry for market; breeds; breeding;

judging; feeds and feeding; diseases and pests; marketing; incubation and brooding. Recitations, lectures, laboratory work, and visits to poultry ranches. Two lectures, one three-hour laboratory period. Second semester. Three units.

5. Elements of Dairying. ASSISTANT PROFESSOR CUNNINGHAM

A study of profitable dairying, herd improvement and dairy sanitation. Secretion, composition, and properties of milk; methods of cream separation, including a study of the construction and operation of centrifugal separators; testing milk and other products; care of milk and cream, and butter making on the farm. Two lectures, one three-hour laboratory period. Second semester. Three units. A deposit of \$1.00 to cover breakage of glassware is required.

6. Dairy Manufactures. ASSISTANT PROFESSOR CUNNINGHAM

A study of the principles and practice of butter making including the use and care of starters; cream ripening; manufacturing and marketing of butter. Cheese making will be studied with special reference to the soft cheeses including Cheddar, Neufchattel, Pimiento and brick. The study of ice cream making will include the natural and artificial flavorings; the use of fillers and stiffeners; types of freezers and the manufacture of ice cream, sherbets, and ices. Prerequisite: Animal Husbandry 5. Open to Juniors and Seniors. Two lectures. One three-hour laboratory period. First semester. Three units.

7. History of Breeds. ASSISTANT PROFESSOR CUNNINGHAM

Characteristics of each breed of horses, cattle, sheep, swine, and goats; origin, history, and development; introduction to America, and adaptability to Arizona conditions. Three hours. Second semester. Three units.

8. Animal Breeding. ASSISTANT PROFESSOR CUNNINGHAM

Principles of breeding, including the study of variation and its causes; the influence of environment on the development of animals; heredity, atavism, reversion, and selection. Special attention is given to the methods of breeding used by the most successful stockmen in the improvement of breeds. Required, optionally with Plant Breeding 1, of all students in agriculture. Prerequisites, Botany 1 or Zoology 1, Animal Husbandry 7. Three hours. First semester. Three units.

## 9. Feeds and Feeding. ASSISTANT PROFESSOR CUNNINGHAM

Principles of animal nutrition; composition and digestibility of various feeds; construction and use of silos; balanced rations; economical feeding of animals for various purposes. Prerequisite, Chemistry 1, 2. Required of all students in agriculture, two three-hour demonstrations. Not offered in 1916-17, but offered in 1917-18. First semester. Three units.

## 10. Advanced Live Stock Judging. PROFESSOR WILLIAMS

A detailed study of the various types, classes, and breeds of live stock; special practice given in the judging of groups, making comparisons, and giving reasons. Trips are made to large herds, and students are required to attend the State Fair at Phoenix. Prerequisites, Animal Husbandry 1 and 7. One lecture, two three-hour demonstrations. First semester. Three units.

## 11. Meat Production. PROFESSOR WILLIAMS

The study of meats and meat products with special emphasis on the selection and preparation of animals for the feed yard, show ring, market, butcher, and consumer. Prerequisite, Animal Husbandry 1 and 9. In 1916-1917, but not offered in 1917-1918. Two lectures, one three-hour laboratory period. First semester. Three units.

## 12. Animal Husbandry Literature. PROFESSOR WILLIAMS

Survey of the literature relating to animal husbandry; selecting and compiling data; assigned readings and reports on special subjects. Open to Juniors and Seniors. Not offered in 1916-17 but offered in 1917-18. Three hours. Second semester. Three units.

## ARCHAEOLOGY

PROFESSOR CUMMINGS

## 1, 2. General Archaeology.

A general course in archaeology which seeks to lay the foundation for the intelligent study of history and social science.

First semester. A study of prehistoric man on the eastern hemisphere, tracing the evidences of his existence, the conditions under which he lived, and his development through the bronze age.

Second semester. A study of prehistoric man on the American continent, tracing the evidences of his existence and the various phases of culture he developed in the different localities he occupied down to historic times, with special attention to the prehistoric inhabitants of Arizona.

Two units, each semester.

3, 4. American Archaeology.

A detailed study of the prehistoric inhabitants of southwestern United States, Mexico, Central America, and South America. Prerequisite, Archaeology 1, 2; History 1, 2. Two units, each semester.

5. Greek Archaeology.

The principal monuments and ruined cities of Greece are studied as illustrating the development of the religious, social, and political customs, and the literature, art, and architecture of the ancient Greeks. Prerequisite, History 9. Two hours. First semester. Two units.

6. Roman Archaeology.

A study of the principal cities and monuments of the ancient Romans as illustrating the early development, their powerful legal and military institutions. Prerequisite, History 10. Two hours. Second semester. Two units.

## ARCHITECTURAL ENGINEERING

PROFESSOR WATERBURY

1. Architectural Drawing and Design.

Elements of architecture. A study of the orders of architecture, perspective, shades and shadows, and rendering. Prerequisite, Mechanic Arts 1, 2. One hour lecture or recitation, and six hours of drafting. First semester. Three units. Laboratory fee 50c.

2. Elementary Architectural Design.

Rendered problems involving simple composition; library research; sketch problems. Prerequisite, Architectural Engineering 1. One hour lecture or recitation, and six hours of drafting. Second semester. Three units. Laboratory fee 50c.

3, 4. Intermediate Architectural Design.

A continuation of the work given in Architectural Engineering 2, including problems involving domes and vaults.

Prerequisite, Architectural Engineering 2. One hour lecture or recitation, and six hours of drafting. Three units, each semester. Laboratory fee 50c, each semester.

#### 5, 6. History of the Development of Architectural Style.

A study of the characteristics and the development of the important architectural styles. Two recitations or lectures. Two units, each semester.

#### 7, 8. Working Drawings.

Three hours of drafting per week, devoted to the preparation of architectural working drawings. One unit, each semester. Laboratory fee 50c, each semester.

#### 9. Fireproofing.

A study of modern fireproof construction and design. Two recitations. First semester. Two units.

#### 10. Office Building Design.

A study of the design of modern office buildings. Prerequisite, Civil Engineering 7. One recitation and nine hours drafting. Second semester. Four units. Laboratory fee, 50c.

#### 12. Estimating.

Problems in the estimation of quantities and costs for various classes of construction. Two recitations. Second semester. Two units.

### ART

#### 1, 2. History of Painting.

A general survey of the history of painting, as follows: Early Christian and Byzantine, Italian, Spanish, Dutch and Flemish, French, German, English, American. Examination and comparison of the methods of each school and period; a critical study of the great masters, their environment, their works, and their influence. Characteristic details of style are studied from photographs and plates. Lectures by the instructor; investigation and reports on assigned topics by students. Three hours. Both semesters. Three units, each semester.

A fee of \$1.00 a year will be assessed in this course for the purchase of material, which becomes the property of the student.



### 3, 4. History of Italian Painting.

An intensive study: The early Christian and Byzantine sources; the Gothic period; the early and the high Renaissance periods; the Decadence; the influence on other schools of painting. Prerequisite, Art 1, 2. Not given in 1916-1917. Two hours. Both semesters. Two units, each semester.

## ASTRONOMY

PROFESSOR DOUGLASS

### 1, 2. Descriptive Astronomy.

The sun, moon, planets, and other celestial objects, with constant views of their telescopic appearance; discussion of the latest theories of the condition of the planets and the evolution of the universe. Non-mathematical; open to all students. Note books will be required. Two hours (with frequent addition of an evening hour). Both semesters. Two units, each semester.

### 3. Engineering Astronomy.

Latitude, longitude, meridian, and time observations and their reductions, with practice work; astronomical measurements; adjustment and handling of instruments. Astronomy 3 is required of Juniors in civil engineering. An elementary knowledge of spherical trigonometry is required for this course. Two hours, and one evening laboratory period of three hours. First semester. Three units.

### 4. Engineering Astronomy.

Continuation of Astronomy 3 with more exact measurements and use of the astronomical transit. One two-hour day period and one three-hour evening period. Second semester. Two units.

## BACTERIOLOGY

PROFESSOR MESERVE

The laboratory is well equipped with the necessary microscopes, hot air and Arnold sterilizers, autoclave and incubators. There is also a liberal supply of glassware and all the reagents, stains, and apparatus employed in class and research work. The equipment will permit a broad scope of work in the field of bacteriology.

1. A brief laboratory course teaching the elements of microscopical and culture methods of examination, and removing the ordinary misconceptions concerning bacteria, rather than developing bacteriologists. Special attention to milk and water examination; the widespread influence of bacteria and yeasts on our daily life. Required of civil engineering and domestic arts students. Prerequisite: Chemistry 1, 2. Two two-hour periods a week during the first half of the first semester. One unit.

## BIOLOGY

PROFESSOR THORNBUR, PROFESSOR VORHIES, AND MR. BROWN

### 1, 2. General Biology.

A course dealing with the fundamental facts and principles of general biological science, introductory to the subjects of Botany and Zoology, and properly a preliminary to advanced work in those subjects. The general principles of Biology as illustrated by plants are studied in the first semester, and as illustrated by animals in the second semester. Students adjudged by the department to be properly qualified may be permitted to enter the course in the second semester, but it is advisable to begin with the first or botanical part of the course. Given by cooperation of the departments of Botany and Zoology. Two recitations, a quiz period and six hours in the laboratory. Four units, each semester. Fee, \$3.00, each semester.

### 3. History of Biological Science.

A lecture course on the history of the development of the sciences of Botany and Zoology, from their early beginnings to the remarkable expansions of the last few decades, and the trend at present. One-half the course will deal primarily with Botany, the other with Zoology. Library work will be required. Prerequisites, Biology 1, 2; Botany 4; Zoology 3 or 4. Three lectures. Three units. First semester.

## BOTANY

PROFESSOR THORNBUR, MR. BROWN

### 1. Elementary Botany.

See Biology 1. Taught in cooperation with the Department of Zoology. Required of all agricultural students.

## 2. Plant Histology.

MR. BROWN

Microscopy, botanical microtechnique, use of the camera lucida, and the photographic camera. The greater part of the laboratory work is given to the use of chemical reagents and stains in the preparation of microscopic slides. For students who intend to teach botany or to take advanced work in this subject. Text: Chamberlain, *Methods in Plant Histology*. Prerequisite, Botany 1. Two lectures and six hours of laboratory work. Second semester. Four units. Laboratory fee, \$2.

## 3. Plant Physiology.

MR. BROWN

Life processes of plants. Investigations of the properties of protoplasm; relations of plants to mechanical forces; influence of chemicals upon plants; relations of plants to water, gravitation, light, respiration, growth, and movement. Of interest to students of plant physiology, because of our interesting flora and climatic conditions. Required of students in horticulture and agronomy. Text: Barnes, *Text-book of Physiology*. Prerequisite, Botany 1. Two lectures and six hours of laboratory work. Second semester. Four units. Laboratory fee, \$2.

## 4. Taxonomy.

PROFESSOR THORNBUR

Identification of plants. For those who expect to continue the study of botany, as well as for those who desire to know the common plants about them, both native and cultivated species. Particular attention to economic plants. Excursions to adjacent mountains, mesas, and river valleys. Texts: Coulter and Nelson, *A New Manual of Rocky Mountain Botany*; Gray, *Field, Forest and Garden Botany*; also other reference works. One lecture and six hours of laboratory work. Second semester. Three units. Laboratory fee \$2.

## 5. Taxonomy.

PROFESSOR THORNBUR

Continuation of course 4. Systematic study of our flora; citation of plant types and co-types; herbarium building; the art of keying plant groups. Study of a group. Different systems of classification are studied. Open to students who desire to continue the study of taxonomy. One lecture and six laboratory hours. First semester. Three units. Laboratory fee \$2.

## 6. General Morphology of Algae and Fungi.

MR. BROWN

The instructor must be consulted before registration. Pre-

requisites, Botany 1 and 2. Hours to be determined. Four units.

7. General Morphology of Bryophytes and Pteridophytes. Four units.

8. General Morphology of Spermatophytes. Four units.

9. History of Botany.

See Biology 3. Taught in cooperation with the Department of Zoology.

10. Grazing Range Studies. PROFESSOR THORNER

An economic study of the native grasses, saltbushes, cacti, and other forage plants, particularly as concerns their grazing value. Different types of ranges with the relation of rainfall to plant growth; the open range as contrasted with the advantages of fenced ranges. Poison plants and range weeds with means of eradication. Range restoration. Recommended for students in animal husbandry and general agriculture. Prerequisite, Botany 4. Not given in 1916-1917. Two lectures and three hours of laboratory work. First semester. Three units.

11. Plant Pathology. PROFESSOR THORNER

The principal groups of parasitic fungi and the plant diseases caused by them, together with methods of control. External factors causing pathological conditions in plants. The commoner plant diseases throughout the country. Prerequisites, Botany 1 and 3. One lecture and six hours laboratory work. First semester. Three units. Laboratory fee \$2.

12. Plant Pathology.

Continuation of course 11. Second semester. Three units. Laboratory fee \$2.

13. Geographical Botany. MR. BROWN

Plant distribution over the earth's surface, with reasons for such distribution. General aspect of the vegetation characteristic of the hygrophytic forest, the tropophytic forest, the sclerophyll forest, the savannah, the steppe, the desert, the tundra. A considerable amount of reading in addition to class-room and field work is required. The lectures are frequently illustrated. Prerequisite, Botany 4. No laboratory work. Four lectures. First semester. Four units.

## 14. Shade and Ornamental Plants. PROFESSOR THORNBUR

Native and introduced flowers, vines, shrubs, and trees adapted for growing in the Southwest; lawn making, the rose garden and hardy bulbous species. Aesthetic arrangement of plants in country and urban homes to secure best results in planting. Different types of landscape gardening. Prerequisite, Botany 4. Two lectures and three laboratory hours. Second semester. Three units. Laboratory fee \$1.

## CHEMISTRY

PROFESSOR GUILD, PROFESSOR BRINTON, MR. ESTILL

## 1, 2. General Chemistry.

PROFESSORS GUILD AND BRINTON AND MR. ESTILL

Lectures and recitations illustrating the fundamental theories of chemistry together with a study of the chemical elements and their compounds. Text book: Smith, *General Chemistry for Colleges*. Three lectures and one three-hour laboratory period throughout the year. One extra conference period without credit for those entering without high school chemistry. Four units, each semester. \*Laboratory fee \$6, each semester.

## 23. Qualitative Analysis.

PROFESSOR BRINTON AND MR. MINISTER

Text-book: A. A. Noyes, *Qualitative Analysis*. One lecture and nine hours laboratory work. First semester. Four units. Laboratory fee \$12.

## 3. Quantitative Analysis.

PROFESSOR BRINTON

Text-book: Blasdale, *Principles of Quantitative Analysis*. Open to students who have taken Chemistry 23. One lecture and nine hours of laboratory work in gravimetric methods of analysis. Second semester. Four units. Laboratory fee \$12.

## 4. Volumetric Analysis.

PROFESSOR BRINTON

A continuation of Chemistry 3, special attention being given to fundamental principles of volumetric analysis and thorough drill in the stoichiometric relation of standard solutions. Six hours laboratory work with occasional lectures. First semester. Two units. Laboratory fee \$6.

\*Fees in Chemistry may be advanced without notice, to meet war prices of chemicals and apparatus.



## 24. Metallurgical Analysis.

PROFESSOR BRINTON

A course dealing with the gravimetric, volumetric, and electrolytic methods of analysis as commonly used in mine and smelter laboratories. The principles underlying speed of manipulation are emphasized in such way as to teach students how to handle a large volume of work without sacrifice of the requisite degree of accuracy. Stress is laid on discrimination in the selection of methods, special emphasis being placed upon accuracy or upon rapidity according to the end sought. Six hours laboratory work with occasional lectures. Second semester. Two units. Laboratory fee \$6.

## 25-32. Special Quantitative Analysis.

PROFESSOR BRINTON

Three hours laboratory work per unit.

- 25. Fuel, Gas, and Oil Analysis. Two units. Laboratory fee \$6.
- 26. Electro-analysis. Two units. Laboratory fee \$6.
- 27. Water Analysis. Two units. Laboratory fee \$6.
- 28. Iron and Steel Analysis. Two units. Laboratory fee \$6.
- 29. Organic Elementary Analysis. Two units. Laboratory fee \$6.
- 30. Food Analysis. Three units. Laboratory fee \$9.
- 31. Soil and Fertilizer Analysis. Three units. Laboratory fee \$9.
- 32. Mineral Analysis. Two units. Laboratory fee \$6.

## 7, 8. Organic Chemistry.

PROFESSOR GUILD

Two lectures and six hours laboratory work throughout the year. Prerequisite, Chemistry 2. Not offered in 1916-17. Both semesters. Four units, each semester. Laboratory fee \$12, each semester.

## 9. Inorganic Preparations.

PROFESSOR BRINTON

Preparation of pure chemical compounds from the crude materials. Prerequisite, Chemistry 4. Six hours laboratory work. Second semester. Two units. Laboratory fee \$6.

## 10. Physical Chemistry.

PROFESSOR GUILD

Lectures and laboratory work. Application of physico-chemical methods to the study of such problems as the deter-

mination of molecular weights, vapor densities, reaction velocity, conductivity, electro-motive force, etc. Prerequisite, Chemistry 3. Not offered in 1916-17. Six hours laboratory work. Second semester. Two units. Laboratory fee \$6.

11, 12. Chemistry of the Rare Elements. PROFESSOR BRINTON

A study of those rarer elements which are not considered in the general courses of inorganic chemistry. Special attention is given to the compounds of tungsten, molybdenum and vanadium, owing to their commercial importance in Arizona. Prerequisite, Chemistry 9. Not offered in 1916-17. One lecture and six hours laboratory work. Both semesters. Three units, each semester. Laboratory fee \$6, each semester.

13. Special Chapters of Inorganic Chemistry.

PROFESSOR BRINTON

Lectures and laboratory practice on selected topics from the field of recent work in inorganic chemistry. Open to students who have taken Chemistry 3, and who have a reading knowledge of German. Chemistry 9 is advised as preparation for this course. Not offered in 1916-1917. Second semester. Two units.

14, 15. Industrial Chemistry. PROFESSOR BRINTON

Lectures and recitations on the application of chemistry to the process of modern industry and manufacture. Two hours. Both semesters. Two units, each semester.

## CIVIL ENGINEERING

PROFESSOR WATERBURY, ASSISTANT PROFESSOR KELTON,  
ASSISTANT PROFESSOR MOOTS

1. Elementary Surveying. ASSISTANT PROFESSOR MOOTS

Use and care of surveying instruments, United States system of land surveys, city surveys, computations. Lectures, recitations, and field work. Open to students who have taken trigonometry, and have taken or are taking Mechanic Arts 1. Required of civil and mining engineering students. Two hours and Saturday morning. First semester. Three units. Laboratory fee \$1.50.

2. Topographic and Mine Surveying.

ASSISTANT PROFESSOR MOOTS

A continuation of Civil Engineering 1. Topographic surveying and drawing, hydrographic surveying, patent surveys, and

underground surveying. Open to students who have taken Civil Engineering 1. Required of civil and mining engineering students. Two hours and Saturday morning. Second semester. Three units. Laboratory fee \$1.50.

3. Geodesy.

PROFESSOR WATERBURY

Precise triangulation work, including measurement of base lines, measurement of angles, adjustment and computation of triangulation systems, and adjustment of precise level circuits. Open to students who have taken Civil Engineering 1, 2 and Astronomy 3. This course may be given as a consultation course. One hour. First or second semester. One unit.

6. Concrete and Masonry Construction.

PROFESSOR WATERBURY

A study of reinforced concrete construction and design, and of other forms of masonry construction, including arches, dams, retaining walls, foundations, and buildings. Prerequisite, Civil Engineering 14. Two recitations and six hours of drafting. Second semester. Four units. Laboratory fee \$0.50.

7. Steel Mill Buildings.

PROFESSOR WATERBURY

Graphical and analytical computation of stresses in roof and bridge trusses; details of structural steel designing; complete design with drawings, estimate of weights, and estimate of cost for a steel mill building. Text-book: Ketchum, *Steel Mill Buildings*. Open to students who have taken Civil Engineering 14. This course may be given as a consultation subject. Two hours and two three-hour drafting periods. First semester. Four units. Laboratory fee \$0.50.

8. Bridge Design.

PROFESSOR WATERBURY

A detailed study of bridge design, including a complete investigation or design with drawings, estimate of weights, and estimate of cost of a steel bridge. Prerequisite, Civil Engineering 7. Two recitations and six hours of drafting. Second semester. Four units. Laboratory fee \$0.50.

9, 10. Railroad Engineering. ASSISTANT PROFESSOR KELTON

Preliminary and location surveys; simple and easement curves, turnouts and switches; principles of economic location as based upon cost of construction, operating expenses, align-

ment, and grades; maintenance of way. The fieldwork consists of the surveys for a railroad of sufficient length to secure familiarity with the methods of actual practice. Each student makes a complete set of notes, maps, profiles, calculations, and estimates of cost. Text-book: Allen, *Railroad Curves and Earthworks*. Open to students who have taken Civil Engineering 1, 2. One hour and one four-hour field or drafting period. Both semesters. Two units, each semester. Laboratory fee \$1.50, each semester.

11. Hydraulics ASSISTANT PROFESSOR MOOTS

A study of velocity and discharge from orifices, weirs, tubes, and pipes; flow in pipes, sewers, and canals; measurement of flow in ditches and rivers; water wheels and pumps. Prerequisite, Mathematics 4. Three recitations and three hours of laboratory work. First semester. Four units. Laboratory fee \$1.00.

12. Hydraulics. ASSISTANT PROFESSOR MOOTS

A study of the principles of hydraulics, covering the same general field as Civil Engineering 11; required for students in mining engineering. Two recitations. Second semester. Two units.

13. Irrigation Engineering. ASSISTANT PROFESSOR MOOTS

Engineering principles relating to the construction and maintenance of canals and reservoirs and the various means of diverting, measuring, and pumping water for use in irrigation. Open to those who have taken Civil Engineering 1, 2, 11, 14. Two hours and one three-hour laboratory and drafting period. This course may be given as a consultation subject. First semester. Three units. Laboratory fee \$0.50.

14a. Mechanics of Materials. ASSISTANT PROFESSOR MOOTS

Analysis and computation of stresses in prisms, beams, columns, and shafts. Text-book: Merriman, *Mechanics of Materials*. Open to students who have taken or are taking Mathematics 5, 6. Three hours. Second semester. Three units.

14b. Materials Testing. ASSISTANT PROFESSOR MOOTS

Laboratory work in the testing of materials used in engineering construction, including cement, concrete, wood, iron, and steel. Open to students who are taking or have taken Civil

Engineering 14a. One three-hour laboratory period. Second semester. One unit. Two units additional may be elected, hours to be arranged. Laboratory fee \$1.50.

15. Contracts and Specifications. PROFESSOR WATERBURY

Essentials of a contract; items included in various kinds of engineering contracts and specifications; preparation of a complete set of specifications and a contract. Text-book: Johnson, *Engineering Contracts and Specifications*. Open to all students. This course may be given as a consultation subject. Two hours. First semester. Two units.

16. Thesis. PROFESSOR WATERBURY

Assigned work on an investigation, design, or original research. No student is permitted to register in this subject unless his previous work has been of high grade. Open to Senior students in civil engineering. First or second semester. Two units.

17. Public Water Supplies. PROFESSOR WATERBURY

Methods of investigation of available supplies of use, including a study of results of chemical analysis of water, and the bacterial examination of water; methods of purification of water; and a study of the design of water systems. Text-book: Turneure and Russell, *Public Water Supplies*. Open to students who have taken or who are taking Civil Engineering 11. This course may be given as a consultation subject. Two hours. First semester. Two units.

18. Sewerage. PROFESSOR WATERBURY

Methods of sewerage purification; sewerage disposal plants; and design of sewer systems. Open to students who have taken or are taking Civil Engineering 11. This course may be given as a consultation subject. Three hours. Second semester. Three units.

19. Elementary Surveying. ASSISTANT PROFESSOR MOOTS

Chaining, compass, level, and transit work; land surveying, traversing and computations. This course is parallel to Civil Engineering 1, and is offered especially for agricultural, mechanical and electrical engineering students. Prerequisite, Mathematics 1b or its equivalent. One lecture-recitation period and one three-hour field period. First semester. Two units. Laboratory fee \$1.50.



## 20a. Surveying.

ASSISTANT PROFESSOR MOOTS

A continuation of Civil Engineering 19. Canal surveying, elementary topographic surveying, etc. This course includes instruction in field measurement of water by means of weirs, floats, and current meter. For agricultural, mechanical and electrical engineering students. One lecture-recitation period and one three-hour field or laboratory period. Second semester. Two units.

## 20b. Irrigation.

ASSISTANT PROFESSOR KELTON

Duty of water, its development, diversion, measurement, and application to land. Offered especially for agricultural students, to be taken in connection with Civil Engineering 20a. One lecture-recitation period. Second semester. One unit.

## 22. Highway Engineering.

ASSISTANT PROFESSOR MOOTS

Highway location and construction; construction of city pavements; bituminous materials for dust prevention and road preservation. Prerequisite, Civil Engineering 1. Two hours. Second semester. Two units.

## CLASSICAL LANGUAGES

## GREEK

## 1, 2. Beginner's Course.

White, *First Greek Book*; Goodwin, *Greek Grammar*; and Xenophon, *Anabasis* (first four books). Four hours. Both semesters. Four units, each semester.

## 3, 4. Homer, Plato, and Lysias.

Homer, *Iliad* (first four books); Plato, *Apology and Crito*; and selections from Lysias. Four hours. Both semesters. Four units, each semester.

## LATIN

The courses below are open to students who have completed the first three years of Latin.

## 1, 2. Livy and Cicero.

Livy, Selections; Cicero, *de Senectute, de Amicitia*. Exercises in prose composition. Four hours. Both semesters. Four units, each semester.

## 3, 4. Tacitus and Horace.

Tacitus, *Germania* and *Agricola*; Horace, *Odes* and selec-

tions from *Epodes*. Three hours. Both semesters. Three units, each semester.

5, 6. Cicero, Horace, and Tacitus.

Cicero, *Letters*; Horace, *Letters*; Tacitus, selections from *Histories*. Three hours. Both semesters. Three units, each semester.

## EDUCATION

PROFESSOR FOSTER AND ASSISTANT PROFESSOR NEAL

The work of this department is planned to meet the needs of those especially who are preparing to enter the teaching profession as high school teachers, principals, and superintendents, to offer such fundamental courses as will afford the proper foundation and training for higher degrees; and so to present the material of educational history, science, and philosophy as to make for broad culture in any student whether he intends to become a teacher or not.

The work of this department, the observation work in the public schools, and the courses in the teaching of high school subjects which are offered in this and other departments of the University, fully meet the requirements for certification as laid down by the school laws of Arizona and most other states.

Provision is now made for three types of students: (1) the prospective high school teacher, (2) the school superintendent or principal, and (3) the student desiring courses in education for general culture rather than as preparation for teaching. The department is so organized as to provide a regular sequence of work in the teacher's training, and students are urged to follow the proposed order and time in registering for courses in education.

The prospective teacher should follow as nearly as possible the following schedule of work:

Sophomore year....first semester.....	History of Education
Sophomore year....second semester....	Principles of Education
Junior year....first semester.....	Educational Psychology
Junior year....second semester.....	Educational Method and Practice
Senior year....first semester.....	Secondary Education

These courses may be supplemented with such other courses in education as the student's individual interests and needs may direct. Courses 9 and 10 in Psychology should be taken by all prospective teachers, preferably during the Sophomore year.

1. History of Education. ASSISTANT PROFESSOR NEAL

This course presents the study of educational principles, practices, and systems of those nations whose ideas and ideals have dominated in educational development. Emphasis will be placed on educational reforms and the leaders who effected them. Present tendencies in education will be studied in the light of psychological and sociological development. Three hours. First semester. Three units.

4. Principles of Education. PROFESSOR FOSTER

An introductory course, designed to give the student a familiarity with and interest in modern educational problems. Three hours. Second semester. Three units.

5. Vocational Education. ASSISTANT PROFESSOR NEAL

A review of the historic types of training for vocation, together with a consideration of the problems and principles of vocational education of the present. Not offered in 1916-17, but offered in 1917-18. Two hours. Second semester. Two units.

6. Secondary Education. ASSISTANT PROFESSOR NEAL

The fundamental principles of organization, classification, and instruction in their bearing upon the practical problems of secondary education. Three hours. First semester. Three units.

7. Philosophy of Education. PROFESSOR FOSTER

An advanced course dealing with the modern theories as to the ideals of education from the standpoint of both form and content. Various types of the more complex problems of education will be investigated, and an attempt will be made to reduce all of educational theory and practice to a philosophical unity. Open to students who have had Education 4. Two hours. First semester. Two units.

8. Comparative School Systems. ASSISTANT PROFESSOR NEAL

The school systems of Arizona and several other states are studied in their individual aspects and in their relation to general educational conditions in the United States. Upon this basis the course is completed by a comparative study of the school systems of Prussia, France, England, and Canada. Not

offered in 1916-17, but offered in 1917-18. Two hours. Second semester. Two units.

9. Education in Religion and Morals. PROFESSOR FOSTER

A consideration of the necessity and the methods of religious and moral training through the periods of childhood and adolescence. Open to students who have had Education 4. Two hours. Second semester. Two units.

10. Social Aspect of Education. ASSISTANT PROFESSOR NEAL

A study of the relation of social needs, desires, and forces to the teaching, organizing, and administrative factors in education. It is strongly recommended that students do some work in principles of sociology or social psychology before taking this course. Open to students who have had Education 4. Offered in 1916-17, but not offered in 1917-18. Two hours. Second semester. Two units.

12. Educational Method and Practice. PROFESSOR FOSTER

This course will deal with the general principles of method as based on psychology, with special reference to secondary school training. Students will be given practice in the preparation of the lesson plans in which the principles developed in the classroom are given practical application to the teaching of secondary school subjects. A considerable amount of school visitation under supervision is required. Open to students who have had Education 14. Five hours. Second semester. Five units.

14. Educational Psychology. PROFESSOR FOSTER

A course supplementary to Courses 9 and 10 in Philosophy (General Psychology), introducing such additional material and indicating such pedagogical implications as to render a knowledge of psychology most serviceable in educational work. Three hours. First semester. Three units.

15. Educational Seminar.

PROFESSOR FOSTER AND ASSISTANT PROFESSOR NEAL

A review of educational literature, including current educational periodicals and intensive study of special topics of professional interest. Open to advanced students in the department. First semester. One unit.

## 16. Educational Seminar.

PROFESSOR FOSTER AND ASSISTANT PROFESSOR NEAL

A continuation of Education 15, but may be begun in the second semester. Second semester. One unit.

## 17. Elementary Education.

ASSISTANT PROFESSOR NEAL

This course will include a study of the peculiar aims and problems of elementary education, in the light of its historical development, its present status, its needs for the future, and the function of the elementary school as a social, political, and economic institution. This course is intended for Juniors and Seniors, and especially those who are training for administrative work. Not offered in 1916-17, but offered in 1917-18. Three hours. Second semester. Three units.

## 18. School Administration.

ASSISTANT PROFESSOR NEAL

This is a course intended to train superintendents and principals of school systems in the smaller cities. A study is made of the educational system of Arizona and much more specifically the administrative and supervisory activities of the school superintendent. Offered in 1916-17, but not in 1917-18. Three hours. Second semester. Three units.

Attention is called to the courses in the teaching of special subjects, listed under the various departments of instruction.

## ELECTRICAL ENGINEERING

MR. FITZGERALD

Work in electrical engineering proper is not undertaken until the Junior year. Courses are given in other engineering subjects, and electives give opportunity for work along non-engineering lines.

## 1. Direct Currents.

The construction, theory, and principles of operation of direct current motors and generators. A thorough study of their characteristics under various conditions, and their application for different classes of work. The study of storage batteries and other direct current auxiliaries. Three one-hour lecture periods. Second semester, Junior year. Three units.

## 2. Alternating Currents.

The theory of alternating currents. A study of alternating current machinery including: alternators, synchronous mo-



tors, rotary convertors, transformers; induction, repulsion, and series motors. This is taken up in a manner similar to direct current machinery. One three-hour period in the laboratory devoted to the study of electrical instruments, their calibration, and electrical measurements. Three one-hour lecture periods, and one three-hour laboratory period. First semester, Senior year. Four units. Laboratory fee \$3.

### 3. Illumination and Distribution.

Cost of producing and transmitting power for lighting purposes, different methods of distribution and their advantages under various conditions, comparing different light sources and their relative value for diverse purposes, the effect and selection of shades. Two one-hour lecture periods. Second semester, Senior year. Two units.

### 4. Electric Traction.

Traffic and schedule studies, selection of equipment, transmission of energy, location of substations and central plant, electrolysis, track lay-out and construction, signal and dispatching systems, construction and equipping of rolling stock, and comparison of alternating current and direct current traction. Two one-hour lecture periods. Second semester, Senior year. Two units.

### 5, 6. Electrical Engineering Laboratory.

Operation and characteristics of commercial machines and allied apparatus, making complete tests of generators, alternators, synchronous convertors, and common causes of trouble and their remedy. Two three-hour laboratory periods. Both semesters, Senior year. Two units, each semester. Laboratory fee \$3, each semester.

### 7. Design of Electrical Machinery.

Practical problems in design applying the theory and empirical relations illustrated in practice and effect of design on characteristics and performance of direct current and alternating current machinery. Two three-hour draughting room periods and one one-hour lecture period. First semester, Senior year. Three units.

### 8. \*Electric Station Design.

Selection and arrangement of electric power station equip-

ment, wiring diagrams and switch board connections, transmission line design, calculations of cost of operation, estimated cost of power delivered and power rates. Two one-hour lecture periods, and one three-hour draughting room period. Second semester, Senior year. Three units. Drawing fee \$1.

#### 9. Electrical Engineering Practice.

A general course for all engineering students, covering the greater part of the electrical field, so as to give a broad idea of the principles and practice of electrical engineering. The laboratory work covers the actual operation and testing of generators and motors. Two one-hour lecture periods, and one three-hour laboratory period. First semester, Junior year. Three units. Laboratory fee \$3.

#### 10. Seminar.

A discussion of various subjects which arise in connection with class-room and laboratory work; and a review of current engineering literature. One one-hour lecture period. First semester, Senior year. One unit.

### ENGLISH COMPOSITION AND RHETORIC

PROFESSOR PERRY, PROFESSOR FEGTLY, MISS FRAZIER

#### 1. Exposition.

MISS FRAZIER

Lectures and the study and practice of exposition; daily and weekly themes. Prescribed for Freshmen. Three hours. First semester. Three units.

#### 2. Argumentation.

MISS FRAZIER

The study and practice of argumentation. Class debates and written arguments, instruction in the right use of authorities, use of catalogues, and indexes. Prescribed for Freshmen. Three hours. Second semester. Three units.

#### 11, 12. Methods of Teaching English.

MISS FRAZIER

For students preparing to teach English in secondary schools. Methods of teaching grammar, rhetoric, composition, literature; discussion of college entrance requirements in English; blocking out courses, and planning and presenting single lessons. Open to Juniors and Seniors. Offered in 1916-17, but not offered in 1917-1918. Three hours. Both semesters. Three units, each semester.

## 19. Advanced Course in Methods of Teaching English.

PROFESSOR PERRY

A review and continuation of the work of English 11, 12. For Seniors who as Juniors took English 11, 12. Not offered in 1916-1917.

## 20. Narration.

PROFESSOR PERRY

The writing of short-stories; consideration of the problems of the short-story writer; the discovery, through the analysis of specimen stories, of helpful principles and devices, and experimentation in their application in short-story writing; frequent themes. Open to college students who have successfully completed English 1, 2. Not offered 1916-17. Three hours. First semester. Three units.

## 21. Public Speaking.

PROFESSOR FEGTLY

A practical course intended to correct faults in delivery, establish sound standards of oratory, and train students in easy, effective oral expression. Constant class-room practice in informal debates and in other forms of public speaking. Open to students who have finished English 1, 2. Three hours. First semester. Three units.

## 21a. Public Speaking.

PROFESSOR FEGTLY

An advanced course in debating and effective public speaking. Special attention given to the strategy of debating and the practice of team work in debate; methods of briefing questions and logical development of argument; study of master orations and addresses and their effective delivery; the use of voice and gesture. Open only to students who have finished English 1, 2, and 21. Two hours. Second semester. Two units.

## 22. Modern English Prose Style.

A theme course based on the study of models. Open to college students who have successfully completed English 1, 2. Offered 1916-1917, but not offered 1917-1918. Three hours. Second semester. Three units.

## ENGLISH LITERATURE

PROFESSOR———, ASSISTANT PROFESSOR LUTRELL, MR. COLODNY

## 3, 4. History of English Literature.

An outline of English literature from its beginning down to the present time. Text-book: Moody and Lovett, *History*

*of English Literature.* Assigned readings from numerous authors. This course is preliminary to all other courses in English literature. Two hours. Both semesters. Two units, each semester.

5, 6. Elizabethan Drama.

Development of the Elizabethan drama from the Miracle Plays, Moralities, and Interludes; the Senecan influence, the work of Lyly, Greene, Peele, Kyd, and Marlowe; a close detailed study of the leading plays of Shakespeare, followed by a cursory treatment of the post-Shakespearian drama. Lectures and discussions. A play is usually given at Commencement by the members of this class. Three hours. Both semesters. Three units, each semester.

7. Nineteenth Century Literature. The Romantic Period.

The historical development of the romantic spirit and its manifestation in the poetry of Wordsworth, Coleridge, Scott, Byron, Shelley, and Keats; the essays of Lamb, Hazlitt, De Quincey, and Emerson; the fiction of Scott, Hawthorne, Poe, Charlotte Bronte, and Emily Bronte. Five hours. First semester. Five units.

8. Nineteenth Century Literature. The Victorian Period.

The change of spirit in the Victorian era; the work of the typical Victorians; Tennyson, Macaulay, Dickens, Thackeray, and Eliot; the various forms of revolt in Arnold, Browning, Rossetti, Swinburne, Morris, Carlyle, Ruskin, Meredith, Hardy, and Stevenson. Five hours. Second semester. Five units.

9, 10. Principles of Literary Criticism.

An historical study of the chief theories of literary criticism to aid the student in forming satisfactory principles of judgment for himself. In the first semester the following authors are studied: Plato, Aristotle, Sidney, Dryden, Addison, Pope, Johnson, and Burke. The second semester is devoted to writers of the nineteenth century, especially Wordsworth, Coleridge, Shelley, Hazlitt, Poe, Arnold, Pater, and various contemporary critics. Primarily for Seniors. Two hours.

15, 16. Contemporary Literature.

Such a study of British and American literature in the last quarter-century as will enable the student to form a clear esti-

mate of present-day tendencies; the decadent and symbolic schools of British poetry, the Irish movement, contemporary American poetry, the romantic and realistic schools of fiction, and the revival of the drama, with especial reference to the influence of Ibsen. Readings assigned in the poetry of Francis Thompson, Dowson, Symons, Henley, Yeats, and Hovey; in the prose of Kipling, Bennett, Wells, Grierson, and Herrick; in the dramas of Ibsen, Pinero, Jones, Shaw, Wilde, Phillips, and Synge. Lectures, discussions and quizzes. Two hours. Both semesters. Two units, each semester.

17, 18. Chaucer.

A large part of the *Canterbury Tales* is read, the *Prologue of the Legende of Gode Wommen*, and some of the minor poems. A purely literary course; a knowledge of Anglo-Saxon is not required. Three hours. Both semesters. Three units, each semester.

25. Use of Books and Elementary Bibliography.

ASSISTANT PROFESSOR LUTRELL

Classification, card catalogues, the more common reference books, bibliographies, indexes, dictionaries, cyclopedias. Open to Freshmen and Sophomores. Lectures, exercises, preparation of bibliographies. Two hours. First semester. Two units.

26. The Library and the School.

ASSISTANT PROFESSOR LUTRELL

Library administration, small school libraries, selection and ordering of books, sales catalogues, library routine. Primarily for students intending to teach. Lectures and practice work. Two hours. Second semester. Two units.

## FRENCH

(See Romance Languages)

## GEOLOGY

PROFESSOR CLAPP

The courses in Geology, with the exception of 13 and 14 are intended for students in mining and applied geology. The advanced courses are offered primarily for those students who wish to take up geology as a profession, or who are engaged in



geological research. They provide opportunities for study in the unexcelled geological field of Southern Arizona, which affords problems of great diversity in superficial, sedimentary, igneous and metamorphic rocks and in ore deposits, and where field work may be carried on at any time of the year.

### 1, 2. General Geology.

The fundamental principles of geology, preparing for the more detailed courses to follow. First semester, dynamical geology; the geological work of the atmosphere, of surface and underground waters, of snow and ice, of earth movements, and of vulcanism. Lectures and recitations, and the interpretation of topographical and geological maps in the laboratory. Second semester, structural geology, the origin of rocks, and historical geology. Continued study of topographical and geological maps; structural problems; the fundamentals of geological mapping; and short field trips in the vicinity of Tucson. Prerequisite, Chemistry 1, 2, and Mineralogy and Petrology 1, which may be taken simultaneously. Two hours and one three-hour laboratory period. Both semesters. Three units, each semester.

### 3. Elementary Economic Geology.

A course in the distribution, geological features, and origin of mineral deposits, including both metallic and non-metallic products, especially those of North America. Prerequisite, Geology 1, 2, and Mineralogy and Petrology 2. Three lecture hours. First semester. Three units.

### 4. Economic Geology.

A course in the more theoretical aspects of the geology of ore deposits, including structural features, the transportation and deposition of minerals, the alteration of wall rocks, classification of ore deposits, and secondary enrichment. The laboratory work consists of the petrographic study of wall rocks and their alterations, and the macroscopic, petrographic, and metallographic study of polished surfaces of ores. Prerequisite, Geology 3 and Mineralogy and Petrology 5. Mineralogy 6 taken simultaneously. Two lecture hours and one three-hour laboratory period. Second semester. Three units.

### 5, 6. Field Geology.

A course in the various methods of geological surveying, including detailed plane table, pacing traverse, reconnaissance,

and underground methods. Geological maps are not only prepared, but material for laboratory study is collected and geological reports are prepared. During the second semester the student works more independently, investigating some selected district. Furthermore it is planned to make the overland trip to the Grand Canyon by way of the petrified forest, painted desert, and northern Arizona volcanic field, taken during the spring of 1916, a biennial feature. Prerequisite, Geology 1, 2. Geology 3, 4 taken simultaneously. Three three-hour laboratory periods. Both semesters. Three units, each semester.

#### 7. Introductory Paleontology.

The general principles of paleontology, and the structure, relationships, and geological significance of the principal types of fossil invertebrates and plants. No attempt is made to describe or identify specific fossils, but instruction is given in methods of collecting fossils and preparing them for identification by a trained paleontologist. Prerequisite, Geology 1, 2, or 13, 14. Not given in 1916-17. Two hours. First semester. Two units.

#### 8. Geology of North America.

A course in the general physiography, stratigraphy, and structural and igneous geology of North America, with especial reference to Arizona. Prerequisite, Geology 1, 2, or 13, 14. Two two-hour lecture-laboratory periods. Second semester. Two units.

#### 9, 10. Advanced Economic Geology.

For graduate students in economic geology, especially for those who wish to work on one of the many varied problems in ore deposits afforded by the mining districts of Arizona. Each student selects his own problem, based either on the laboratory study of material on hand or preferably on material gathered by the student in the field. The work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

#### 11, 12. Advanced Field Work.

For graduate students. Mapping an area in Arizona selected for the study of some particular problem in physiography, structural geology, petrology, or ore deposits. The problem

selected is studied in detail, and the results presented in form for publication.

### 13. Dynamical Geology and Physiography.

For students in general arts and science, to familiarize them with the geological processes, erosion, transportation, sedimentation, deformation, and eruption, and with the development and sculpturing of land forms. Lectures, taken with Geology 1, illustrated by maps, diagrams, specimens, and stereopticon. Prerequisite, Chemistry 1, 2, or Entrance Chemistry. Two hours. First semester. Two units.

### 14. Historical Geology and Evolution.

A continuation of Geology 13. A general view of the past history and evolution of the earth and of its life as recorded by the sedimentary rocks and their enclosed fossils. Prerequisite, Geology 13. Two hours. Second semester. Two units. (May be given with Geology 2).

### 16. Engineering Geology.

A course designed for civil engineering students, which deals especially with structural geology and its relation to tunneling, foundations, landslides, underground water supplies, and kindred topics; and considers briefly certain metallic and non-metallic mineral resources, notably structural materials, clays, cements, and building stones, fuels, and iron. Prerequisite, Geology 1 or 13. Two hours. Second semester. Two units. (May be given with Geology 2).

### 18. Geology of Building Materials.

A short course in geology for students in architecture and engineering; which deals briefly with dynamical and structural geology and their bearing on building stones, clays, and cements. Not given in 1916-17. Two hours. Second semester. Two units.

## GERMAN

ASSOCIATE PROFESSOR OTIS

### 1, 2. Elementary German.

First semester: Mosher's *Lern- und Lesebuch* used as basis for work in grammar and composition. Second semester: Mosher's *Lern- und Lesebuch* completed and reviewed as

basis for conversation. Grammar reviewed with P. V. Bacon's *German Grammar*. Reading of Storm's *Immensee*, and Heyse's *L'Arrabbiata*. Five hours. Both semesters. Four units, each semester.

### 3, 4. Advanced German.

First semester: P. V. Bacon's *German Composition*. Reading of Meyer-Foerster's *Karl Heinrich* and Schiller's *William Tell*. Conversation based on Manley's *Ein Sommer in Deutschland*. Second semester: Bacon's *German Composition* completed. Reading of Sudermann's *Frau Sorge*; Heine's poems and *Die Harzreise*; Scheffel's *Ekkehard*. Conversation based on Manley's *Ein Sommer in Deutschland*. Prerequisite, German 1, 2. Five hours. Both semesters. Four units, each semester.

### 5, 6. Life and Works of Lessing, Goethe, and Schiller.

First semester: Lessing; study of life of Lessing, his *Emilia Galotti*, and *Nathan der Weise*. Study of life of Schiller, and of Maria Stuart. Second semester: Study of Schiller's *Die Jungfrau von Orleans*; Goethe; study of life of Goethe, *Hermann und Dorothea*, *Goetz von Berlichingen*, and *Iphigenie auf Tauris*. Prerequisite, German 3, 4. Three hours. Both semesters. Three units, each semester.

### 5S, 6S. Reading and Conversation in Scientific German.

Text Dippold's *Scientific German Reader*. Prerequisites, one year of Chemistry and one of Physics; German 3, 4 or may be taken with German 3, 4. Two hours. Both semesters. Two units, each semester.

### 7, 8. German Literature in the Nineteenth Century.

First semester: The Romanticists and their successors. Reading of works of Kleist and Grillparzer. Second semester: The rise of Naturalism and Symbolism. Reading of Works of Wildenbruch, Fulda, Sudermann, and Hauptmann. Prerequisite, German 3, 4. Not offered in 1916-17, but offered 1917-18. Two hours. Both semesters. Two units, each semester.

### 9, 10. Methods, Theory, and Practice of Teaching German.

Observation of methods used in teaching German, reports and discussions on these observations. Lectures to develop

ideas of teaching German, especially in secondary schools. Prerequisite, German 5, 6, or may be taken with German 5, 6. One hour. Both semesters. One unit, each semester.

### 11, 12. Goethe's *Faust*.

First semester: A close study of Goethe's life and of *Faust*, Part I. Text: Goethe's *Faust*, edited by Calvin Thomas, Part I. Second semester: Goethe's *Faust*, Part II. Text: Goethe's *Faust*, edited by Calvin Thomas, Part II. Prerequisite, German 5, 6. Not offered 1916-17, but offered 1917-18. Two hours. Both semesters. Two units, each semester.

### 13, 14. History of German Literature.

Lectures and selected readings to show the development of German literature to the nineteenth century. This course is required of all students majoring in the Department of German. Prerequisite, German 5, 6. Two hours. Both semesters. Two units, each semester.

## GREEK

(See Classical Languages)

## HISTORY

ASSISTANT PROFESSOR HUBBARD AND ASSISTANT PROFESSOR REID

### 1, 2. Expansion of the American People.

ASSISTANT PROFESSOR REID

The political and social development of the American people from the settlement of the Atlantic seaboard to the present time; the analysis of the various complex forces which have resulted in the ideas and institutions of the day; the adaptation of European peoples and institutions to American conditions; the early westward movement; the development of western democracy; the social and political changes following the Civil War; the settlement of the far West. Open to all students. Three hours. Both semesters. Three units, each semester.

### 3, 4. Mediaeval History.

ASSISTANT PROFESSOR REID

A history of Europe from the fall of the Roman Empire in the West to the time of the Reformation; the origin and development of the various European states; the origin, growth,



and significance of the religious, social, and political institutions of the period. Three hours. Both semesters. Three units, each semester.

5, 6. Nineteenth Century Europe.

ASSISTANT PROFESSOR HUBBARD

The liberal and reform movements of Europe during the last century; the evolution of constitutional government; various movements toward national unity; the rise of modern Italy; the Franco-Prussian war; the rise of modern Germany; English reform bills of 1832, 1867, and other political developments. Not offered in 1916-17, but offered in 1917-18. Three hours. Both semesters. Three units, each semester.

7, 8. Constitutional History of the United States.

ASSISTANT PROFESSOR HUBBARD

Formation of the Union, political and constitutional history of the United States, based on letters and speeches of American statesmen, public documents, and special histories. The purpose of the course is to direct the student to collect and organize source material. Open only to students having had History 1, 2. Not offered in 1916-17, but offered 1917-18. Three hours. Both semesters. Three units, each semester.

9. Greek History.

ASSISTANT PROFESSOR REID

The history of Greece to the death of Alexander. A study of the development of the political, social, and economic life of the Greek people. Three hours. First semester. Three units.

10. Roman History.

ASSISTANT PROFESSOR REID

The history of Rome to the fall of the Empire. A survey of the political history as a basis for the study of the organization of the Republic and the Empire; the social and economic development of the people. Emphasis will be placed upon the relation of Rome to the Mediterranean World. Three hours. Second semester. Three units.

11. Development of the English Nation.

ASSISTANT PROFESSOR HUBBARD

The English people from the earliest times to the end of the Tudor period. The influence of Church and Continental relations; the causes and events relative to the development of

English social and political institutions. The student is expected to have a clear idea of the Constitution as developed to the close of the period. Three hours. First semester. Three units.

12. Development of English Party Government.

ASSISTANT PROFESSOR HUBBARD

Beginning with the close of the Tudor period, a study of the events and legislation causing and directing the growth of English political parties. The prerogatives of the crown, the development of the cabinet system, elections, methods of legislation, and the reform bills of the nineteenth century. Three hours. Second semester. Three units.

13, 14. Modern Europe. ASSISTANT PROFESSOR HUBBARD

European history from the beginning of the Reformation to the Napoleonic period. European civilization of the sixteenth, seventeenth, and eighteenth centuries. Second semester; an intensive study of the French Revolution. Three hours. Both semesters. Three units, each semester.

15. The Balkan States. ASSISTANT PROFESSOR HUBBARD

A study of the origin and development of the Balkan States; the Near East problem as related to present day European politics; the causes and events of the late wars. The history during the last three decades will be studied as much as possible from original sources. Open to students having had at least one course of college history. Two hours. First semester. Two units.

16. The great European War. ASSISTANT PROFESSOR HUBBARD

A study of the origin and development of the great European alliances; the political, social, and economic development of the Great Powers in the twentieth century; immediate causes, events, and international problems of the great war. Open to students having had one course of college history. Two hours. Second semester. Two units.

### HOME ECONOMICS

ASSOCIATE PROFESSOR THOMAS, ASSISTANT PROFESSOR WILLIAMS,  
MISS BISHOP

1, 2. Foods and Cookery. ASSISTANT PROFESSOR WILLIAMS

A general survey of the principles and a development of

skill in the technique of cookery, and a knowledge of household processes connected with food. Offered to all college students. No prerequisites. One lecture; two three-hour laboratory periods. Both semesters. Three units, each semester. Laboratory fee \$5.00, each semester.

3, 4. Food Economics. ASSISTANT PROFESSOR WILLIAMS

A course dealing with the quantitative aspects in the purchase and preparation of food, the cost and relative values of food, and the planning and serving of various kinds of meals. Prerequisites, Home Economics 1, 2; Chemistry 1, 2; prerequisite or parallel, Chemistry 23 and Chemistry 3, or Zoology 4 and 5 (Physiology). One lecture. Two three-hour laboratory periods. Both semesters. Three units, each semester.

5, 6. Extension Course in Foods and Cookery.

ASSISTANT PROFESSOR WILLIAMS

A course offered to women of Tucson. The character of the course and the credits and hours will be determined at the opening of the year.

7, 8. Dietetics. ASSISTANT PROFESSOR WILLIAMS

A survey of the nutritive values of foods and the food requirements of the individual throughout life. Diets for different ages and conditions are worked out in the laboratory. Prerequisites, Home Economics 1, 2, 3, 4; prerequisite or parallel, Chemistry of Foods and Bacteriology; Chemistry 23 and 3 and Zoology 4 and 5 (Physiology). Two two-hour periods. Both semesters. Two units, each semester. Laboratory fee \$2.00 each semester.

9, 10. House Planning, Furnishing, and Decoration.

ASSISTANT PROFESSOR WILLIAMS

A study of various types of modern houses, and the application of the principles of art and economy in the furnishing and decoration of them. Two two-hour periods. Both semesters. Two units, each semester.

11, 12. Theory and Practice of Teaching Foods and Cookery.

ASSISTANT PROFESSOR WILLIAMS

Not offered in 1916-1917.

## 13, 14. Elementary Clothing and Hand Work.

ASSOCIATE PROFESSOR THOMAS

This course gives practice in the use of sewing machines and their attachments, the making of the fundamental stitches, the drafting and use of patterns, making of simple garments, darning, patching, and simple embroidery. The course is prerequisite for all Textile and Clothing courses except Millinery. Lectures, recitations, laboratory work. Two three-hour periods. Both semesters. Three units, each semester. Laboratory fee \$2.00 each semester.

## 15, 16. History of Costume and Costume Design.

ASSOCIATE PROFESSOR THOMAS

Not given in 1916-17.

## 17. Drafting, Draping, and Pattern Making. MISS BISHOP

Practice in drafting, cutting, fitting, and designing sleeves, collars, waists, skirts, and gowns. Prerequisite, Home Economics 13, 14. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$5.00.

## 18, 19. Dressmaking. MISS BISHOP

The making of waists, dresses, and trimmings. Prerequisite, Home Economics 13, 14, 17. Two three-hour laboratory periods. Both semesters. Two units, each semester. Laboratory fee \$2.00 each semester.

## 20, 21. Advanced Dressmaking. MISS BISHOP

A course in designing and making afternoon and evening gowns, including a study of the proportions of the human figure and application of the principles of design and color to the costume. Prerequisite, Home Economics 13, 14, 17, 18, 19. Two three-hour laboratory periods. Both semesters. Two units, each semester. Laboratory fee \$2.00 each semester.

## 22, 23. Millinery. ASSOCIATE PROFESSOR THOMAS

A course giving instruction in making wire frames, buckram and cape net frames, hats, renovating old materials, manufacturing artificial flowers and other trimmings. Two three-hour laboratory periods. Both semesters. Two units, each semester. Laboratory fee \$2.00 each semester.

## 24. Textiles.

## (a) Textiles.

DR. MESERVE

The identification of fibres and their substitutes by means of the microscope and chemical tests. Hours to be arranged. Prerequisite or parallel. Bacteriology and Zoology 4, 5 (Physiology).

## (b) Textile Manufacture. ASSOCIATE PROFESSOR THOMAS

This course includes the history and development of textiles, a study of the processes of manufacture and identification and economic use of fabrics. Prerequisite, Home Economics 24 (a). Hours to be arranged. Three units. Laboratory fee \$2.00.

25, 26. Theory and Practice of Teaching Textiles and Clothing. Not offered 1916-17.

## HORTICULTURE

ASSISTANT PROFESSOR JOHNSON

## 1. Horticultural Crops. ASSISTANT PROFESSOR JOHNSON

A study of vegetables and fruits with special reference to their adaptability and uses throughout Arizona. A general view of the principles and practices in horticulture, fitting the student for diversified farm work or for general science teaching. Required, optionally with Agronomy 1, of all students in agriculture. Three hours. First semester. Three units.

## 2. Principles of Plant Propagation.

ASSISTANT PROFESSOR JOHNSON

A thorough and practical training in the propagation of plants, including a study of soils used in the nursery and seed bed; seed testing; seeding and transplanting; and multiplying of plants by separation, division, cuttings, layerings, budding and grafting. Reference reading and the preparation of reports. One lecture and two three-hour laboratory periods. Second semester. Three units.

## 3. Vegetable Gardening. ASSISTANT PROFESSOR JOHNSON

Practical and theoretical training in the general principles underlying successful intensive farming; detailed study of the various crops grown for the home and for market, with special reference to Arizona conditions. Lectures, laboratory, and



practice on the farm. Three hours. First semester. Three units.

4. Pomology.

Orchard management, and detailed study of deciduous fruits, including planting, cultivation, pruning, spraying, and description and history of varieties. Three hours First semester. Three units.

5. Pomology Laboratory. ASSISTANT PROFESSOR JOHNSON

Describing and judging varieties; pruning; preparation of spray materials; study of spraying apparatus and orchard implements. To be taken in connection with Horticulture 4, or Horticulture 7. One three-hour laboratory period. One unit.

6. Citrus Fruits.

Culture of citrus fruits with special reference to the citrus districts in the United States. Citrus nursery management; citrus orchard management; citrus insects and diseases; packing and marketing; judging. Three lectures, one three-hour laboratory period. Second semester. Four units.

7. Small Fruits. ASSISTANT PROFESSOR JOHNSON

Small fruits such as the strawberry, the grape, and the various bush fruits. To be accompanied by Horticulture 5, Pomology Laboratory. Not offered in 1916-17. Two hours. First semester. Two units.

8. Horticultural Literature. ASSISTANT PROFESSOR JOHNSON

Assigned readings in bulletins and standard works upon horticulture; daily and weekly reports presenting a comprehensive view of the general field of horticulture and laying the foundation for research work. Open to Juniors and Seniors. Three hours. Second semester. Three units.

## LATIN

(See Classical Languages)

## LAW

Courses in this department are open only to such students as have thirty units of academic credit.

1. Introduction to the Study of Law.

Nature, origin, evolution, and sources of law; a history of English and American law, together with a discussion of the methods of legal study. First semester. Three units.

2, 3. Contracts.

Offer and acceptance; requisites of contracts under seal; express and implied conditions; illegality; impossibility of performance; discharge of contracts. Both semesters. Three units, each semester.

4, 4a. Torts.

Trespass; excuses for trespass; negligence of duties of land owners; hazardous occupations; liability for animals; malicious prosecution; competition; strikes and boycotts; business combinations. Both semesters. Three units, each semester.

5. Agency.

Relation; appointment; liabilities of principal; liabilities of agent; parties to writings; undisclosed principal; delegation and termination of agency. Second semester. Three units.

6, 7. Property.

Distinction between real and personal property; acquisition of rights in personal property; gifts; bailment; lien; pledge; real property; tenures; estates; seisen and conveyances; incidents of ownership in real property; fixtures; easements; covenants as to use; public rights; franchises; rents. Both semesters. Two units, each semester.

8. Criminal Law.

Nature and sources of criminal law; the criminal act; attempts; criminal intent; circumstances affecting illegality of act; specific offenses; crimes against property; conspiracy. First semester. Three units.

9. Common Law Pleading.

A general survey of the principles of common law pleading, followed by a consideration of the more important forms of action. Second semester. Three units.

## 10, 11. Equity.

Nature of jurisdiction; specific performance of contracts; partial performance; consideration; marketable title; bills for an account; specific prevention; specific reparation of torts; injunctions for waste; trespass; nuisance; infringement of patents and copyrights; interference with business relations; violations of rights of privacy. Both semesters. Two units, each semester.

## 12. Property.

A continuation of Law 7. First semester. Three units.

## 13. Constitutional Law.

Nature and sources of American constitutional law; express powers, implied powers; citizenship; privileges and immunities of citizenship; due process of law; police power; regulation of commerce; money; war. Second semester. Three units.

## 14. Municipal Corporations.

Nature and functions; creation, alteration, and dissolution; legislative control; powers and duties of directors; rights of stockholders; forfeiture of charter. First semester. Two units.

## 15. Conveyances.

Accretion; prescription; creation of interests in land by agreement or conveyance; methods of transfer of interests at common law and under statutes; execution of deeds; interpretation of instruments of conveyance; covenants for title; conditions; fraudulent conveyances. Second semester. Two units.

## 16. Conflict of Laws.

The principles and rules of "private international law;" a study of the nature and effect of domicile and nationality; jurisdiction of courts in proceedings; respective applicability and effect of domestic laws and foreign laws in marriage and other domestic relations; contractual, quasi-contractual, delictual, and judgment obligations; property interests. First semester. Three units.

## 17. Quasi-Contracts.

Origin and nature; benefits conferred in misreliance on right or duty, misreliance resulting from mistake of law, misreliance

on invalid contract, on illegal contract, on unenforceable contract; benefits conferred through dutiful intervention in another's affairs; benefits conferred under constraint, constraint of duress, of legal proceedings, of tax or assessment; action for restitution as alternative remedy for breach of contract and for tort. Second semester. Three units.

#### 18, 19. Evidence.

Functions of judge and jury; presumptions; burden of proof; judicial notice; classification of evidence; admissions; principles and rules relating to misleading or unimportant matters; character; confessions; hearsay; witnesses' opinions; expert testimony; evidence relating to execution, contents, and interpretation of writings; real evidence; rules of substantive law; competency of witnesses; privilege, impeachment, confirmation, and examination of witnesses. Both semesters. Three units, each semester.

#### 20. Persons and Domestic Relations.

Marriage; promise to marry and breach; marriage as a contract or relation; annulment; divorce; separation. Parent and child; custody, support, services and earnings of child, relation as to torts. Infants; period of infancy; voidable acts; disaffirmance. Husband and wife; rights of each as to the property, earnings, services, and society of the other; husband's duty to support wife and wife's authority to bind husband by contracts; contracts, conveyances, and devises of married women; liability of married women for torts and responsibility for crimes. First semester. Two units.

#### 21. Sales.

Subject matter of sales; executory and executed sales; bills of lading; seller's lien and right of stoppage *in transitu*; fraud; factor's acts; warranty and remedies for breach of warranty; Statute of Frauds. Second semester. Two units.

#### 22. Suretyship.

Personal suretyship compared with real suretyship; suretyship obligations compared with insurance and indemnity obligations; guaranty and other forms of suretyship in relation to the Statute of Frauds; suretyship in transactions involving negotiable instruments; fidelity contracts and judicial bonds; surety's defenses due to original defects in his obligation or to

its subsequent discharge; surety's right to subrogation, indemnity, contribution, or exoneration; creditor's right to surety's securities. First semester. Three units.

### 23. Damages.

Respective functions of court and jury in estimating damages; exemplary, liquidated, nominal, direct, and consequential damages; avoidable consequences; counsel fees; certainty, compensation, damages for non-pecuniary injuries; value; interest and damages in certain actions of tort and contract. Second semester. Two units.

### 24. Bailments and Carriers.

Bailments in general; special classes of bailments involving ordinary liability, exceptional liability, innkeepers, common carriers of goods, common carriers of passengers. First semester. Three units.

### 25. Bills and Notes.

A consideration of bills of exchange, notes, and checks, including formal requisites; acceptance, endorsement, transfer, extinguishment; obligation, diligence, specialty character. Second semester. Three units.

### 26. Partnership.

Nature, purposes, and members; creation of partnerships; nature of partner's interest; firm name and goodwill; mutual rights and duties; actions between parties at law and in equity; powers of partners; liability for acts of partners in contract and tort; general liability; dissolution and notice; consequences of dissolution; dissolution agreements; distribution of assets; limited partnerships. First semester. Three units.

### 27. Mortgages.

Essential elements of legal and equitable mortgages; rights of mortgagor and mortgagee at law and in equity; title, possession; dower, curtesy; waste; priorities; collateral agreements; foreclosure; redemption; extension; assignment and discharge. Second semester. Two units.

### 28. Wills and Administration.

Acquisition of property on death of former owner; escheat, descent, occupancy; the making, revocation, and republication



of wills; payment of legacies and distribution; ademption and lapse of legacies. First semester. Two units.

### 29. Water Rights and Irrigation Law.

Irrigation at common law; other systems of irrigation law; appropriations; basis of right of appropriation; patentees and appropriators; waters subject to appropriation; priorities; transfer of water rights. Second semester. Two units.

### 30. Mining Law.

A study of mining titles with reference to mining rights. First semester. Two units.

### 31. Bankruptcy.

Jurisdiction of the United States and the States; who may be a bankrupt; who may be petitioning creditors; acts of bankruptcy where property passes to the Trustee; provable claims; protection; exemptions and discharge. Second semester. Two units.

### 32. Future Interests.

Vested and executory interests; rule against perpetuities; provisions for forfeiture and restraint on alienation. First semester. Two units.

### 33. Insurance.

Marine, fire, and life insurance. Insurable interest in various kinds of policies; concealments; misrepresentations; warranties; amount of recovery; subrogation; powers of agents, assignees, and beneficiaries. Second semester. Two units.

### 34. Private Corporations.

The nature, formation, and organization of corporations; irregular incorporation; corporate powers; promoters; directors, and shareholders; creditors, stock issue and payment; transfer. First semester. Three units.

### 35. Public Utilities.

The nature, rights, and duties of public service callings; railroads and canals; telephone and telegraph; gas, water, and other public utilities. Second semester. Three units.

The Case method, supplemented by lectures and text-books is used, with the aim of furnishing the students in the Department of Law with such training as will best fit them for the practice of law. The courses are so presented as to familiarize the student with legal methods of reasoning and to train him in legal habits of thought. Courses are open to both men and women regularly entered as students in the College of Letters, Arts, and Sciences.

A practice court is an organized part of the department, with the purpose of affording the student practical instruction in pleading and practice.

By taking a combined course in collegiate and law studies it is possible for students to shorten from seven to six years the time required to earn the degrees of Bachelor of Arts and Bachelor of Laws.

Students in law may enter either as candidates for the degree of Bachelor of Laws or as special students if not qualified to become candidates for degrees.

The requirements for admission to the course for the degree of LL. B. are the same as those governing entrance to other departments of the College of Letters, Arts, and Sciences.

A graduate of an approved college may, upon presentation of diploma, enter upon strictly law courses as a candidate for a degree.

As a special student, one wishing to supplement his educational training by the study of special subjects in the Department of Law, may be admitted to certain classes by permission of the faculty.

## MATHEMATICS

PROFESSOR LEONARD AND ASSOCIATE PROFESSOR MEDCRAFT

### 1a. College Algebra.

Prescribed for all engineering courses. First semester. Three units.

### 1b. Plane Trigonometry.

Prescribed for all engineering courses. First semester. Two units.

### 2. Analytic Geometry.

Prescribed for all engineering courses. Prerequisite, Mathematics 1a and Mathematics 1b. Second semester. Four units.

3. Differential Calculus.

Fundamental principles and formulae of the differential calculus, with their applications. Prescribed for all engineering courses. Prerequisite, Mathematics 2. First semester. Four units.

4. Integral Calculus.

Fundamental principles and formulae of the integral calculus, with their applications; including the use of tables of integrals. Prescribed for all engineering courses. Prerequisite, Mathematics 3. Second semester. Four units.

5. Analytical Mechanics.

The mathematical treatment of the fundamental principles of dynamics, statics, etc. Prescribed for all engineering courses. Prerequisite, Mathematics 4 and Physics 1. First semester. Four units.

6. Analytical Mechanics.

Continuation of Mathematics 5. Prescribed for all engineering courses. Prerequisite, Mathematics 5. Second semester. Four units.

8. Computation.

Application of approved methods for calculating, including the use of the slide rule. Prerequisite, Mathematics 1a and Mathematics 1b. Second semester. Two units.

9. Algebra and Trigonometry.

A briefer course than Mathematics 1a and Mathematics 1b. Not offered in 1916-17. First semester. Four units.

10. Elementary Analysis.

A briefer course in analytic geometry and calculus. Not offered in 1916-17. Second semester. Four units.

11. Analytic Geometry of Space.

Fundamental formulae and a brief study of surfaces, curves, and their equations. Prerequisite, Mathematics 2. First semester. Two units.

## 12. Higher Plane Curves.

A study of algebraic and transcendental curves, from the analytical and graphical point of view. Prerequisite, Mathematics 2. Second semester. Two units.

## 13. History of Mathematics.

A brief study of the development of this branch of exact science. Prerequisite, Mathematics 4. First semester. Three units.

## 14. Teaching of High School Mathematics.

A study of the methods of teaching arithmetic, algebra, geometry, and trigonometry, and incidentally some of the history of mathematics. Prerequisite, Mathematics 2 and Education 1 and 4. Second semester. Three units.

## 15. Differential Equations.

An elementary study of differential equations and their applications. Prerequisite, Mathematics 4. First semester. Two units.

## 16. Spherical Trigonometry.

Fundamental principles and formulae of the spherical trigonometry, with applications to surveying and astronomy. Prerequisite, Mathematics 1b. Second semester. Two units.

## 17. Advanced Algebra.

A study of selected topics. Prerequisite, Mathematics 1a. First semester. Two units.

# MECHANIC ARTS

PROFESSOR HENLEY, PROFESSOR KING, MR. HENDRY, MR. B. SMITH

## 1. Engineering Drawing.

PROFESSOR KING

Elements of mechanical drawing, including lettering, tracing, and blue printing. Making and reading of working drawings. Commercial drafting room practice. Required of all engineering students. Two three-hour drafting room periods. First semester. Two units. Drawing fee \$1.00.

2. Descriptive Geometry. PROFESSOR KING AND MR. SMITH

Elements of descriptive geometry, including problems in warped surfaces and intersection of solids. Required of all engineering students. Prerequisite M. A. 1 or equivalent. One one-hour recitation period and two three-hour drafting room periods. Second semester. Three units.

3. Pattern Shop and Foundry. MR. HENDRY

Bench and machine work in wood; elements of pattern and foundry work. Three three-hour shop periods. First semester. Three units. Laboratory fee \$4.50.

4. Forge and Machine Shop. MR. HENDRY

Forge work in iron and steel; tempering, case hardening and annealing; characteristics of iron and steel; elementary machine shop processes. Three three-hour shop periods. Second semester. Three units. Laboratory fee \$4.50.

5, 6. Machine Shop. MR. HENDRY

Machine shop practice; erection and care of machinery; machine tool, bench, and floor work; modern industrial practice. Two three-hour shop periods. Both semesters. Two units, each semester. Laboratory fee \$3, each semester.

8. Carpentry. MR. HENDRY

Wood work including care of tools, framing, jointing, etc. Two three-hour shop periods. Second semester. Two units. Laboratory fee \$3.00.

9. Forge and Metals. MR. HENDRY

Forge work in iron and steel, pipe work, drill press, care of small machinery. Two three-hour shop periods. First semester. Two units. Laboratory fee \$3.00.

10. Mechanical Drawing. PROFESSOR KING AND MR. SMITH

A general elementary course for non-engineering students. Two three-hour drafting room periods. Second semester. Two units. Drawing fee \$1.00.

11, 12. Free Hand Drawing and Lettering.

PROFESSOR KING AND MR. SMITH

An elementary course for students in general science and



liberal arts. Two three-hour drawing room periods. Either semester. Two units, each semester.

## MECHANICAL ENGINEERING

PROFESSOR HENLEY, PROFESSOR KING, MR. B. SMITH

### 1. Mechanisms. PROFESSOR KING

Theory and design of linkages, gears, cams, screws, and other machine elements. A study of the relative motions of machine parts. Graphical methods are followed throughout. Required of students in mechanical and electrical engineering. One one-hour lecture period, and two three-hour drafting room periods. First semester. Three units. Drawing fee \$1.00.

#### 1a. Mechanisms. PROFESSOR KING

A short course designed for those who have not the time needed for the full course. One one-hour lecture period. First semester. One unit.

### 2. Machine Drawing and Empirical Design. PROFESSOR KING AND MR. SMITH

This course treats of the elements of machine design, taking up such subjects as shafts, bearings and lubrication, pulleys, belts, clutches, standard machine parts, fastenings, etc. Required of students in mechanical and electrical engineering. One one-hour lecture period and two three-hour drafting room periods. Second semester. Three units.

### 3. Heat Engines. PROFESSOR HENLEY

An elementary course in the theory of steam and other heat engines. Problems in application of thermodynamic theories. Laboratory work in use of the indicator, and other experimental apparatus. Required of students in mechanical, electrical, and civil engineering. Two one-hour lecture periods and one three-hour laboratory period. Second semester. Three units. Laboratory fee \$3.00.

### 4. Pumping Machinery. PROFESSOR HENLEY

A study of pumps, compressors, vacuum pumps, blowers, exhausters, etc. Problems in performances and efficiencies and in selection of equipment for specific purposes. Two one-hour lecture periods and one three-hour laboratory period. First semester. Three units. Laboratory fee \$3.00.

## 5, 6. Machine Design. PROFESSOR KING AND MR. SMITH

Design of machinery and machine parts. Consideration of conditions of construction and operation. Proportioning of parts for strength and efficiency. Required of students in mechanical and electrical engineering. (Electrical engineering students take course 15 instead of course 6 in the second semester). One one-hour lecture period and two three-hour drafting room periods. Both semesters. Three units, each semester. Drawing fee \$1.00.

## 7, 8. Mechanical Laboratory. PROFESSOR HENLEY

Testing different types of engines, boilers, pumps, injectors, and other apparatus. Investigation of problems arising in the design, selection, or operation of machinery. Reports of tests, inspections, etc. Required of students in mechanical and electrical engineering. (Electrical engineering students omit one laboratory period.) One one-hour lecture and one or two three-hour laboratory periods. Both semesters. Two or three units, each semester. Laboratory fee \$6.00.

## 9, 10. Engine Design. PROFESSOR HENLEY

Design of the main features of a steam or gas engine, pump, or compressor, with the completion of as many of the working details as the time permits. Required of students in mechanical engineering. Two three-hour drafting room periods. Both semesters. Two units, each semester. Drawing fee \$1.00.

## 11. Advanced Heat Engines. PROFESSOR HENLEY

A continuation of course 3, taking up present day tendencies in the development of steam engines and boilers, steam turbines, internal combustion motors, etc. Required of students in mechanical engineering. Two one-hour lecture periods. First semester. Two units.

## 12. Power Plants. PROFESSOR HENLEY

The economic design and operation of power and pumping plants. Problems involving the selection of equipment to perform a given duty with a probable minimum expense. Required of students in mechanical engineering. Two one-hour lecture periods. Second semester. Two units.

## 13. Senior Seminar.

Required of fourth year students in mechanical engineering. One one-hour conference period. First semester. One unit.

## 14. Small Power Plants and Pumping Machinery.

PROFESSOR HENLEY

An abridged course in small machinery installations and problems encountered with the ordinary small pumping plants. Two one-hour lecture periods and one three-hour laboratory or field period. First semester. Three units, Laboratory fee \$3.00.

## 15. Mechanical Design of Electrical Machinery.

PROFESSOR KING

A continuation of course 5, paying particular attention to the special problems involving the design of motors, generators, and other electrical machinery. Required of students in electrical engineering. Two three-hour drafting room periods. Second semester. Two units.

## 16. Junior Seminar.

Required of third year students in mechanical and electrical engineering. One-hour conference period. Second semester. One unit.

## 17. Heating and Ventilation.

This course deals with the different methods of steam, hot water, and hot air heating; principles and practice of ventilation, drying, cooling, etc. Required of students in architectural engineering. Three one-hour lecture and recitation periods. First semester. Three units.

## 18. Plumbing and Piping.

A course in the principles underlying the sanitary equipment of buildings and the layout of proper piping for water supply, vacuum, compressed air lines, and similar pipe work. Required of students in architectural engineering. One three-hour drafting room period. (Including one lecture.) First semester. One unit.

## METALLURGY

ASSOCIATE PROFESSORS WILLIS AND CHAFMAN

## 2. Fire Assaying.

The theory of assaying is developed in this course. Special attention is given to the constitution of the ore and the necessary fluxes, with the aim of making the student thoroughly familiar with the principles involved. A decided effort is made to make this course as practical as possible. Although the importance of accurate work is at no time overlooked, constant efforts are made to train the student to handle a large amount of work in as short a time as possible. Required of all students in mining engineering. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$15.

## 7. Ore Dressing.

A study of the theory and practice of concentration, determination of the laws of classification and jigging, laboratory testing of ores for the determination of processes, operation and adjustment of commercial sizes of ore dressing machinery, and testing of commercial machines. Special attention is paid to flotation processes. Required of all students taking mining engineering. Two one-hour lectures. First semester. Two units. One three-hour laboratory period. First semester. One unit. Laboratory fee \$3.

## 18. Ore Dressing Laboratory.

A research problem to determine a method of economical extraction by concentration, and the making of a flow sheet. Required of all students taking the mining or metallurgical options in the mining engineering course. Two three-hour laboratory periods. Second semester. Two units. Laboratory fee \$5.

## 11. General Metallurgy and Metallurgy of Copper and Lead.

The theory and practice of metallurgy, fuels, refractories, processes, and furnaces. The metallurgy of copper includes roasting, blast furnace matte smelting, pyritic smelting, and reverberatory matte smelting, smelting of oxidized copper ores to pig copper, smelting and refining of native copper ores, copper converting, and hydro-metallurgy of copper. The metallurgy of lead covers smelting of ores for lead only, blast furnace smelting with lead as a collector, calculation of charges,

desilverization processes, and furnace products and their treatment. Required of all students taking mining engineering. Two one-hour lectures. First semester. Two units. One three-hour laboratory period. First semester. One unit. Laboratory fee \$5.

#### 11a. Metallurgical Laboratory Practice.

Laboratory practice running parallel to Metallurgy 11, including experiments in roasting, sintering, lead refining, electrolytic copper refining, furnace tests, and leaching methods for the extraction of copper. Required of all students taking the metallurgical option of the mining engineering course. Three three-hour laboratory periods. First semester. Three units. Laboratory fee \$10.

#### 12. Metallurgy of Iron, Steel, and Alloys.

This course covers the ores of iron, the blast furnace and its accessories, blast furnace reactions, calculation of furnace charges, blast furnace production of pig iron, manufacture of bronzes, brasses, and other alloys. Required of all students taking mining engineering. Two one-hour lectures. Second semester. Two units.

#### 14. Metallurgy of Gold and Silver.

This course includes the theory and practice of stamp milling, chlorination, and amalgamation. Cyaniding is taken up in considerable detail, with laboratory practice and testing for cyanide processes. Required of all students taking the mining or metallurgical options of the mining engineering course. One one-hour lecture and seven hours in the laboratory. Three units. Second semester. Laboratory fee \$10.

#### 6. Metallurgical Laboratory Thesis Work

Original problems in the treatment of ores—experiments to determine the best method of treatment. This work is only given in the fifth year.

#### 8. Metallurgy of the Rare Metals.

Metallurgy of zinc, cadmium, nickel, mercury, bismuth, tin, antimony, cobalt, platinum, tungsten, and molybdenum. Open only to students taking post-graduate work. Two one-hour lectures. Second semester. Two units.



### 10. Smelter Design.

A practical metallurgical problem such as may confront the student on entering the practical field. Open only to graduate students. One lecture and two three-hour laboratory periods. Second semester. Three units.

### 13. Advanced Metallurgy.

For graduate students in metallurgy. Designed for those who wish to work on one of the problems afforded by the complex ores of Arizona. The work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

### 16. Electrometallurgy.

A course dealing with the principles and processes involved in producing and refining metals by the use of electricity. Prerequisites, Physics 2 and Chemistry 3. One lecture and one three-hour laboratory period. Second semester. Two units.

### 20. The Business of Metallurgical Operations.

A detailed study of the underlying factors which govern the operation of metallurgical plants, the buying and selling of mine and mill products, analysis of smeltery contracts, efficiency and safety applied to smelters, compilation and analysis of operating reports, smelter management. Two lectures. Second semester. Two units.

Field Excursions. See "Mining Engineering" for description of these.

## MILITARY SCIENCE AND TACTICS

PROFESSORS BROWN AND MESERVE

### 1, 2, 3, 4. Military Tactics: Drill.

This work is required of all male students throughout four semesters of college work. The work consists of drill for three periods a week, one hour each, for the time above indicated. Three hours. Both semesters. One unit, each semester.

### 9, 10. Military Tactics: Theory.

The work consists of recitations, once a week, for two semesters, and covers the school of the soldier; the school of

the squad; school of the battalion; close and extended order; ceremonies; battle exercises; and target practice, bayonet exercise, and fencing. Text-books: *U. S. Drill Regulations*, *Manual of Guard Duty*, *Outlines of First Aid for the Hospital Corps*, *Manual of Small Arms Firing Regulations*, and *Manual of Bayonet Exercise and Fencing*. One hour. Both semesters. One unit, each semester.

#### 5, 6, 7, 8. Military Science.

Each course is pursued for one semester, two hours a week, and the ground covered by all four courses, in four semesters, includes elementary law, elementary international law, military law, ordnance and gunnery, military engineering, the art of war, battles and campaigns. Two-hours. Both semesters. Two units, each semester.

## MINERALOGY AND PETROLOGY

PROFESSOR BUTLER

### 1. Crystallography and Blow-Pipe Analysis.

Lectures, laboratory work, and recitations. This course is intended to prepare a student for the work in Determinative Mineralogy and only such portions of the included subjects are emphasized as are essential for the proper understanding and determination of minerals. Thorough drill is given in these. In the laboratory work in crystallography, a student is required to become thoroughly familiar with the crystal systems and forms through the study of wooden crystal models. Later, he determines the forms of several hundred natural crystals by the use of a pocket lens and a contact goniometer. The course in Blow-Pipe Analysis includes practice in the use of the blowpipe and in the operations ordinarily included under the term "blowpipe analysis," experimental work upon known substances until facility in the manipulation of the various tests is attained, and the analysis of a score or more of unknown substances. Prerequisite, Chemistry 2. Two lectures and two three-hour laboratory periods. First semester. Three units. Laboratory fee \$3.00. Each student must provide himself with a hand-lens and a set of blowpipe apparatus of a type approved by the instructor.

### 2. Determinative Mineralogy.

Lectures, laboratory work, and recitations. About one hundred and seventy-five mineral species and scores of varie-

ties of these are studied in this course. Emphasis is placed upon the classification of minerals by methods that involve a knowledge of the physical characteristics as revealed visually and through the use of a pocket-knife. Chemical and blow-pipe tests are employed merely to corroborate inferences drawn from such observations. The end sought is the almost instantaneous recognition in the field of those minerals likely to be encountered in mining operations, rather than the ability to classify any mineral after a long series of tests in the laboratory. Each student is expected to determine over two thousand individual specimens during the course. Prerequisite, Mineralogy and Petrology 1. Two lectures and two three-hour laboratory periods. Second semester. Three units. Laboratory fee \$3.00

#### 4. Petrology.

A course intended to familiarize a student with the characteristics of the commoner rocks in such a way as to make reasonably accurate field identification possible. The methods employed are solely those applicable to hand specimens without the use of microscopic thin sections. Portions of the laboratory periods are used for lectures and oral quizzes. Each student is expected to classify about seven hundred and fifty individual specimens. Prerequisite, Mineralogy and Petrology 2. Two three-hour laboratory periods. Second semester. Two units.

## MINING ENGINEERING

PROFESSOR BUTLER AND ASSOCIATE PROFESSOR WILLIS

#### 10. Principles of Mining.

This course is introductory to all succeeding mining courses. Topics discussed are, the history and importance of the mining industry and its influence on the settlement and civilization of the world, practical methods of field prospecting, and methods of excavation. Methods of quarrying, placer mining, open cut mining, and coal mining are taken up in some detail. Required of all students taking mining engineering. Four one-hour lectures. First semester. Three units.

#### 13. Mining Machinery.

This course deals with machinery in its application to mining, taking up in detail churn and diamond drills, hand and

machine tools for excavation, air compression, rock drills, electric drills, tunneling machines, hydraulicking machinery, coal mining machinery, drainage and pumping machinery, and ventilation and illumination apparatus. Surface plants, including shops, ore bins, head frames, rock houses and breakers also are discussed. Required of all students taking the mining or metallurgical options in the mining engineering course. Three one-hour lectures. First semester. Two units.

#### 14. Methods of Mining.

This course deals with the ways of blocking out underground ore bodies; the correct interval between levels; the different methods of stoping, with the range of application to different kinds of ore bodies, and to flat or steeply pitching veins; the advantages and disadvantages of underhand, overhand rill-cut, and shrinkage stopes. A careful consideration is given to complete systems of development and mining, such as transverse, shrinkage stopes, pillars, square set stopes, top slicing, back caving, and the various methods of filling and flushing. The student is taught to apply the principles set forth by the solution of many problems taken from practice. Required of all students taking mining engineering, Four one-hour lectures. Second semester. Two units. (For those electing the mining option). Two one-hour lectures. Second semester. One unit. (For those electing the geology or metallurgy option.)

#### 14a. Mining Laboratory.

This course is concerned with practical underground mining, including the use and care of underground machinery, methods of mining, shaft sinking, tunneling, handling of explosives, timbering methods, steel sharpening, and the varied other problems arising in actual underground operation. Required of all students taking the mining option in the mining engineering course. Three three-hour laboratory periods. Second semester. Three units. Laboratory fee \$10.

#### 7. Practical Mining.

Before entering upon the work of the Senior year, all students who are candidates for the degree of B. S. in Mining Engineering and Metallurgy, must have spent at least six weeks in practical underground mining or in practical metallurgical or mill work. The fulfillment of this requirement must be evidenced by the certificate of the superintendent

or foreman, by notes and sketches of the processes observed, and a report on such work, to be made before November 1 of the same year.

#### 15. Mill Design.

This course deals with the solution of problems in the design and construction of concentration and reduction works; with working drawings, bills of material, specifications, and estimates. Open to graduate students only. One one-hour lecture period. Two three-hour laboratory periods. Three units.

#### 16. Mining Engineering Thesis Work.

Special problems and investigations in mining methods, machinery, and equipment. Open to graduate students only.

#### 17. Advanced Mining Engineering.

For graduate students in mining engineering, especially for those who wish to work on one of the varied problems afforded by the mining districts of Arizona. All work is carried on under the supervision of the instructor, with whom weekly conferences or seminars are held.

#### 19. Mine Examinations and Reports.

This course covers the sampling, the calculation of the tonnage, and the valuation of ore bodies; the sampling and valuation of placer deposits, the preparation of reports; and engineering ethics. Prerequisite, completion of the freshman, sophomore, and junior work in Mining Engineering. Two lectures. Second semester. One unit.

#### 21. The Business of Mining.

A detailed study of the underlying factors which govern the operations of mining corporations, factors which influence the value of mining securities, analysis and classification of mining costs, scientific management, efficiency engineering, systems of labor compensation, contracts and specifications, leasing systems, purchase of supplies, and the compilation of operating reports. Two lectures. First semester. Two units.

Note. All students in mining engineering in the Senior year are required to give one hour to a seminar for the discussion of current technical literature in mining, for which work no credit is given.



### Field Excursions.

In connection with the courses in Mining Engineering and Metallurgy, trips are made to mining districts in Arizona and Sonora. These usually occupy one or two weeks in March or April. These trips are required of all candidates for the degree of B. S. in Mining Engineering and Metallurgy; and give the student a splendid opportunity for the close study and inspection of mining and metallurgical plants, rock formations, and minerals of commercial value. The students are accompanied by members of the faculty, and strong efforts are made to make the trips of the greatest possible practical value. The trips are carefully scheduled. Notes, with sketches, measurements and photographs, are taken, and are elaborated into comprehensive reports by each student after his return.

During March, 1916, a trip was made to Bisbee, Douglas, Tombstone, Gleason, and Pearce, and opportunity was given for the study of the mining practice on both large and small scales, cyanide plants, and smelters. During April, 1917, the mining districts and reduction plants of Globe, Miami, and Ray will be visited. This trip gives an excellent opportunity for the student to observe large scale practice at profitable properties. The recent opening of the Inspiration mine, mill, and smelter, handling 15,000 tons daily, makes this trip especially attractive.

Many shorter, week-end trips to near-by mines, mills, or smelters are taken by upper classmen.

### SHORT COURSES IN MINING AND METALLURGY

The University of Arizona offers short courses extending over a period of twenty weeks, which combine laboratory and lecture instruction in mining, metallurgy, ore-dressing, geology, surveying, and allied subjects. These courses are designed primarily for mature students who are unable to take the regular courses leading to a degree, and are intended to supply that special knowledge which will improve a man's work and be of assistance to him in obtaining and satisfactorily filling higher positions in mines, mills, and smelters. They may also be taken to great advantage by prospectors and by others who feel more or less interest in mining, and desire to secure some insight into the vocation. The only entrance requirements are seriousness of purpose, and the ability to read and write intelligently and to work ordinary problems in arithmetic. The expenses involved are nominal.

During 1916-1917 the following courses will be offered:

1. Prospector's Course. Oct. 30 to Dec. 2, inclusive.
2. Field Geology Course. Dec. 4 to 16, inclusive.
3. Assaying Course. Jan. 3 to 13, inclusive.
4. Metallurgists' Course. Jan. 15 to Feb. 3, inclusive.
5. Flotation Course. Feb. 5 to 10, inclusive.
6. Miners' Course. Feb. 12 to Mar. 24, inclusive.

Further details relative to these courses are set forth in a separate pamphlet which may be had upon application to the Dean of the College of Mines and Engineering.

## MUSIC

The Department of Music offers an opportunity for all University students to secure regular courses in piano, voice, stringed and wind instruments.

The courses in the history and theory of music as enumerated below may be taken as electives to count toward a degree.

### 1. History of Music.

A general survey of the development of music; primitive music, music of ancient civilization, church music, choral music, oratorio, and opera; the evolution of instruments and instrumental forms; the study of great master composers and their relation to the musical movements of the time. Two hours. First semester. Two units.

### 2. History of Music.

A continuation of Music 1. Two hours. Second semester. Two units.

## OPTICAL MINERALOGY AND PETROGRAPHY

PROFESSOR GUILD

### 5. Optical Mineralogy.

The microscopic study of the rock-forming minerals. Prerequisites, Geology 2 and Mineralogy 1. Two three-hour laboratory periods. First semester. Two units. Laboratory fee \$2.50.

## 6. Petrography

Preparations of thin sections of rocks for microscopic study, and study of a type selection of rocks. Prerequisite, Mineralogy 5. Two three-hour laboratory periods. Second semester. Two units. Laboratory fee \$2.50.

## 7. Crystallography.

Measurement, projection, and drawing of crystals. Prerequisite, Mineralogy 4. Six or twelve hours laboratory work. Either semester. Two or four units. Laboratory fee \$2.50.

# PHILOSOPHY AND PSYCHOLOGY

PROFESSOR VON KLEINSMID AND PROFESSOR FOSTER

## 1. Introduction to Philosophy.

A preliminary study of the field of philosophical discussion, pointing out its chief problems and proposing methods for their investigation. The aim of the course is to train in independent reflection and to make the student acquainted with philosophical method and material. Not open to Freshmen. Three hours. Second semester. Three units.

## 2. Logic.

An elementary course in the theory of reasoning, including a study of the essentials of logic and training in the detection of fallacies. Not open to Freshmen. Two hours. First semester. Two units.

## 3. History of Ancient and Mediaeval Philosophy.

A study of the development of speculative thought to the beginning of the modern period, together with a consideration of its relation to practical life. Open to Juniors and Seniors. Three hours. First semester. Three units.

## 4. History of Modern Philosophy.

A study of the problems of Philosophy from the time of the Renaissance to the present day. A continuation of course 3. Three hours. Second semester. Three units.

## 5. Ethics.

A study of the essential nature and the growth of morality with the application of moral theory to psychological, social, and economic problems of the present day. Open to those who have had course 1. Not offered in 1916-17, but offered in 1917-18. Three hours. First semester. Three units.

## 6. Present Philosophical Tendencies.

A consideration of contemporary thought, designed to give acquaintance with current philosophical problems and discussions. Open to those who have had courses 3 and 4. Not offered in 1916-17 but offered in 1917-18. Three hours. Second semester. Three units.

## 8. Philosophy of Religion.

A philosophical interpretation of the nature of religious consciousness, together with a survey of the history of religions. Open to those who have had course 3. Offered in 1916-17 but not in 1917-18. Three hours. Second semester. Three units.

## 9. General Psychology.

A study of sensation, imagination, perception, attention, higher intellectual processes, and the affective life. This course is prerequisite to all other courses in Psychology and is designed as well for students satisfying the requirements of other departments. Not open to Freshmen. Three hours. First semester. Three units.

## 10. Advanced General Psychology.

A continuation of course 9 but a more intensive study of the general phases of Psychology. Open to those who have had course 9. Three hours. Second semester. Three units.

## 11. Child Psychology.

A study of the genesis of mental states as they appear in the evolutionary series, with special attention to the Psychology of Childhood. Should be preceded by a course in Biology. Open to those who have had courses 9 and 10. Three hours. First semester. Three units.

## 12. Psychology of Adolescence.

A consideration of the various aspects of adolescence, em-

phasizing those phases of greatest importance to parents and teachers. Open to those who have had courses 9 and 10. Three hours. Second semester. Three units.

### 13, 14. Experimental Psychology.

An attempt to familiarize the student with psychological apparatus, methods of procedure, and results, providing for an intimate study of normal mental phenomena. Should be taken by all who purpose to do special work in Psychology. Open to Seniors who have had courses 9 and 10. Not offered in 1916-17, but offered in 1917-18. Two hours. Both semesters. Two units, each semester.

### 15, 16. Abnormal Psychology.

A consideration of psychopathology as observed in various abnormalities. A study of mentally exceptional children, the criminal mind and insanity, together with a brief investigation of the occult. Open to Seniors who have had courses 9 and 10. Offered in 1916-17 but not in 1917-18. Three hours. Both semesters. Three units, each semester.

### 17, 18. Clinical Psychology.

A study of the methods of clinical examination, tests, scales of measurement, types, and classification. Open only to those advanced students who have the permission of the professor in charge. Not offered in 1916-17 but offered in 1917-18. Two hours. Both semesters. Two units, each semester.

## PHYSICAL TRAINING

Opportunities for gymnasium work are open to men, but physical training is required for women only.

### 1, 2. Physical Training.

Required of all first year students. Elementary Swedish gymnastics, breathing exercises, simple folk-dances—emphasis constantly on improvement in standing and walking. Three hours. One unit.

### 3, 4. Physical Training.

Prerequisite, Physical Training 1, 2. A course in dancing. Exercise to develop coordination of arms with the other mus-



cles of the body. Constant exercises in breathing. The study of typical dances of various nations, and an attempt to make the student use the dance as a fine form of exercise for all the muscles of the body, as well as a delightful form of expression. Three hours. One unit.

## 5. Physical Training.

No prerequisite. All young women in the University may attend. A recreation course, consisting first, of simple Swedish movements of easy folk-dances,—and then, some of the best social dances of ancient and modern times. An effort is made to develop an intelligent attitude toward dancing, and to improve the standards of social dancing by comparing the dances of various centuries, and analyzing the elements which make them desirable, enjoyable, and beautiful types of diversion. One hour.

## ATHLETICS

The climate of Tucson permits out of door athletics throughout the academic year. The main out of door sports are football, baseball, tennis, and track work. Basketball is played indoors. Every student is encouraged to undertake some form of athletics. Tennis is played during the entire year.

The percentage of students engaged in athletics is unusually large. Team work is provided to add interest to sports. Competitive athletics are pursued with the schools, colleges, and universities of Arizona, New Mexico, and Southern California.

An interscholastic meet is held in April for all the high schools and academies of the State.

## PHYSICS

PROFESSOR DOUGLASS

### 1, 2. General Physics.

Lectures, recitations, and laboratory work. First semester: Mechanics, sound, and heat. Second semester: Electricity and light. The laboratory experiments give prominence to mechanics, electricity, and light but include the study of wave motions and their application to other subjects. Prerequisites, Elementary Physics and Mathematics 1. Those who have not had elementary physics will be required to take an extra unit of work without credit, consisting of the recita-

tion and lecture work of Physics 21, 22. Required in all engineering courses. Two hours and two two-hour laboratory periods. Both semesters. Four units, each semester. Laboratory fee \$1.

### 3. Mechanics and Sound Measurements.

Calculation and measurement of forces, laws of falling bodies, mechanics of rotation. Simple harmonic motion and wave motion. One hour and two three-hour laboratory periods. First semester. Three units.

### 4. Electrical and Optical Measurements.

Electrical machines and instruments used in mechanical engineering, and optical instruments handled in mining and civil engineering courses. Prescribed for the third year in civil engineering courses. One hour and two three-hour periods. Second semester. Three units.

### 5. Thermodynamics and Heat.

The foundation principles underlying mechanical engineering, latent and specific heats, conductivity, expansion, mechanical equivalent, high temperatures, cycles, entropy, properties of steam, etc. One hour and two three-hour periods. First semester. Three units.

### 6. Optical Measurements.

Continuation of course 4, spectroscopy and polarization. Two three-hour laboratory periods. Second semester. Two units.

### 8. Electrical Measurements.

Continuation of course 4, potentiometer, thermo-electricity and low resistance measures. Two three-hour laboratory periods. Second semester. Two units.

### 21, 22. Descriptive Physics.

Historical and descriptive consideration of Physics principles, with practice in handling and reading various measuring instruments. This course cannot be taken for credit by students who have had preparatory physics. Two hours and one three-hour laboratory period. Both semesters. Three units, each semester.

## PLANT BREEDING

PROFESSOR FREEMAN AND ASSISTANT PROFESSOR BRYAN

## 1 Principles of Plant Breeding. ASSISTANT PROFESSOR BRYAN

The general principles of plant breeding; detailed study of the methods pursued and results obtained by leading plant breeders in various Experiment Stations and in private work. Required, optionally with Animal Husbandry 8, of all students in agriculture. Prerequisite, Botany 1. Three hours. Second semester. Three units.

## ROMANCE LANGUAGES

PROFESSOR TURRELL, MISS POST, MISS HOLMES

## FRENCH

## 1, 2. Elementary French. PROFESSOR TURRELL AND MISS POST

First semester: Fraser and Squair, *French Grammar*, (Part 1); Aldrich and Foster, *French Reader*. Second semester: Allen and Schoell, *French Life*; Halévy; *L'Abbé Constantin*. Composition and dictation, with drill on the irregular verbs. Five hours. Both semesters. Four units, each semester.

## 3, 4. Advanced French. MISS POST

First semester: Fraser and Squair, *French Grammar*, (Part II); Merimée, *Colomba* or *Carmen*; Lamartine, *Graziella*; Sand, *La Mare au Diable*. Second semester: Victor Hugo, *Les Misérables*, (abridged); Balzac, *Eugénie Grandet*; Zola, *La Débâcle*, etc. Composition and conversation, using Talbot's *Le Français et sa Patrie*. Five hours. Both semesters. Four units, each semester.

## 3a, 4a. Advanced French. (For students entering with two year of high school French.) MISS POST

Grammar, composition, etc., as in French 3; reading as in French 4. Three hours. Both semesters. Two units, each semester.

## 5. French Literature to the Nineteenth Century.

PROFESSOR TURRELL

The classical French dramatists: plays of Corneille, Racine and Molière: Lectures on the eighteenth century: Voltaire,

Rousseau, Diderot, etc. Beaumarchais, *Le Barbier de Seville*. Library readings. Prerequisite, French 3, 4, or 3a, 4a. Three hours. First semester. Three units.

# 6. French Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. The Romanticists, Victor Hugo, Musset, Scribe, Augier. Recent literary movements in France. Pailleron, Dumas, Rostand, Zola, Sardou, Maeterlinck, etc. Prerequisite, French 5. Three hours. Second semester. Three units.

# 7, 8. Advanced Composition and Conversation.

PROFESSOR TURRELL

Koren, *French Composition* and Kron, *French Daily Life* will be used as a basis for conversation. Composition and essays. Prerequisite, French 3, 4, or 3a, 4a, and 5, 6, or may be taken with 5, 6. Two hours. Both semesters. Two units, each semester.

# 9, 10. Nineteenth Century Prose.

PROFESSOR TURRELL

Study of the development of the French novel in the Nineteenth Century. Reading of works of Hugo, Balzac, Dumas, Flaubert, Zola, Daudet, Bazin, Loti, France, Rolland, etc. Prerequisite, 5, 6, or may be taken with 5, 6. Not to be given in 1916-17. Two hours. Both semesters. Two units each semester.

# 13. Methods of Teaching French.

PROFESSOR TURRELL

Study and comparison of various grammars and texts, with particular reference to the needs of high schools and to college entrance requirements. Prerequisite, French 5, 6, 7, 8, or an equivalent. One hour. First semester. One unit.

## SPANISH

# 1, 2. Elementary Spanish.

MISS HOLMES

First semester: De Vitis, *Spanish Grammar*; Turrell, *Spanish Reader*, begun. Second semester: Grammar and Reader completed; Alarcón, *El Capitán Veneno*. Conversation and dictation throughout the year. Five hours. Both semesters. Four units, each semester.

## 3, 4. Advanced Spanish.

Miss Post

First semester: Galdós, *Marianela*; Valdés, *La Hermana San Sulpicio* or *La Alegría del Capitán Ribot*. Second semester: Valera, *Pepita Jiménez*; Blasco-Ibañez, *La Barraca*, etc. Composition, letter writing, and conversation throughout the year, using Crawford, *Spanish Composition*. Five hours. Both semesters. Four units, each semester.

## 3a, 4a. Advanced Spanish. (For students entering with two years of high school Spanish.)

Miss Post

Composition, conversation, etc., as in Spanish 3, 4. Three hours. Both semesters. Two units, each semester.

## 5. Spanish Literature to the Nineteenth Century.

PROFESSOR TURRELL

Lectures in Spanish on the early literature of Spain, the "Siglo de Oro," etc., with library readings. Class study of Cervantes, *Don Quijote*, (Selections); Lope de Vega, *La Moza de Cántaro*; Calderón, *La Vida es Sueño*, etc. Prerequisites, Spanish 3, 4 or 3a, 4a. Three hours. First semester. Three units.

## 6. Spanish Literature in the Nineteenth Century.

PROFESSOR TURRELL

Particular study of the drama. Reading of Morátin, *El Sí de las Niñas*; Gutiérrez, *El Trovador*; Nuñez de Arce, *El Haz de Leña*; Echegaray, *El Gran Galeoto*; Galdós, *Electra*; Benavente, *Los Intereses Creados*, etc. Prerequisite, Spanish 3, 4, or 3a, 4a. Three hours. Second semester. Three units.

## 7, 8. The Literature of Mexico and South America.

PROFESSOR TURRELL

A survey of the literary history of Mexico. Reading of works by the best authors, as included in the *Biblioteca de Autores Mexicanos*, etc. Part of the second semester will be given to the discussion of the literatures of other Spanish-American countries, with selected readings. Prerequisite, Spanish 5, 6. Two hours. Both semesters. Two units, each semester.

## 9, 10. Advanced Composition and Commercial Spanish.

Miss Post

A practical course in writing and speaking Spanish. Remy *Spanish Composition*; Harrison, *Commercial Spanish Reader*,



and Harrison, *Spanish Correspondence* will be used. Prerequisite, Spanish 3, 4, or 3a, 4a, and for A. B. students, 5, 6. Two hours. Both semesters. Two units, each semester.

- 11, 12. Scientific Spanish. (For Technical and Engineering students.) PROFESSOR TURRELL

Willcox, *Scientific and Technical Spanish*. Study of vocabulary of electricity, steam engines, mining, bridge building, etc. *Boletín de la Unión Panamericana* and supplementary readings. Prerequisite, Spanish 3, 4, or 4a. Also at least one year each of physics and chemistry. Two hours. Both semesters. Two units, each semester.

14. Methods of Teaching Spanish. PROFESSOR TURRELL

Study and comparison of various grammars and texts, with reference to the needs of high schools, and particularly the adaptation of various methods to the teaching of the language in Arizona and the Southwest. Prerequisite, Spanish 5, 6, 9, 10, or an equivalent. One hour. Second semester. One unit.

#### EVENING COURSES

- Spanish 1a, 2a. Elementary Spanish. MISS HOLMES

Covering the work of Spanish 1. First semester of first year, emphasizing as far as possible conversation and oral work. May not be taken by regular students as a substitute for Spanish 1, except by special permission. Tuesday and Thursday evenings at 7:30. Two hours. Both semesters. Two units, each semester.

Note: An advanced course in Spanish (covering the second semester of the first year) will be given in 1916-17 if a sufficient number desire the course.

#### ITALIAN

- 1, 2. Elementary Italian. PROFESSOR TURRELL

Edgren, *Brief Italian Grammar*; Bowen, *Italian Reader*; Goldoni, *I Vero Amico*, Wilkins and Altrocchi, *Italian Short Stories*; Fogazzaro, *Peregrinatio Rochus*, etc. Prerequisite at least two years of French or Spanish. Not to be given in 1916-17. Three hours. Both semesters. Three units, each semester.

- 3, 4. Advanced Italian. PROFESSOR TURRELL

Bergen and Weston, *An Italian Reader of Nineteenth Century Literature*; Manzoni, *I Promessi Sposi* (Selections); Read-

ings from Tasso, Ariosto and Petrarch; Dante, *Divina Commedia*, (Selections). Two hours. Both semesters. Two units, each semester.

## SOCIAL SCIENCE

PROFESSOR BROWN

### 1, 2. Introduction to Economics.

The general principles underlying the science, with emphasis upon practical application, in business, industry, and the home. The elements of fundamental lines of business activity that are important to all who have to earn a living or manage a home, including: markets and buying; prices; insurance; taxation; credits; transportation; elements of cost; principles of labor efficiency. Because of local importance much attention is given to the application of economic principles to mining and agriculture. Open to all students. Three hours. Both semesters. Three units, each semester.

### 3. Industrial and Commercial Organization.

The scientific basis of large scale industry through analysis of principles of competition, combination, monopoly and the savings of integration; various business units from the point of view of comparative efficiency for different kinds of business; methods of business consolidation; scientific management and elements of cost. Materials of commerce and commercial geography with reference to foreign trade and competition. The tariff system and trust problems. Prerequisite, Social Science 1, 2. Offered in 1916-17 and alternate years. Four hours. First semester. Four units.

### 4. Transportation and Commerce.

The materials of commerce, American commercial geography, raw products and other material sources of American business and transportation. Rise of the American railway system; its past and present relation to the development of agriculture, mining, manufacturing, and other industries. Relation of the railroad to the government and the public; rights of the shipper; railway rates. Open to those who have had Social Science 1, 2. Offered in 1916-17 and alternate years. Four hours. Second semester. Four units.

### 5. Corporation Organization and Finance.

Organization and management; how and where to organize; powers and privileges of corporations in the different states;

minority rights. Business development and promotion of various properties and enterprises, with special reference to the promotion and development of mining companies. Offered in 1915-16 and alternate years. Three hours. First semester. Three units.

#### 5a. Financial Institutions and Investments.

A study of the investment market, including: financial agents and institutions; stock exchanges; stock market; investments of securities; methods and laws of investment and speculation; relative merits of railway stocks, bonds, municipal bonds, industrial, irrigation, and mining securities. Offered in 1915-16 and alternate years. Three hours. Second semester. Three units.

#### 7. Sociology and Social Reform.

An introduction to the study of society and social problems, including: principles of social evolution; the social function of the home and the family; the problem of the dependent, the defective, and the delinquent; modern methods of social service and scientific social reform. Open to all students. Three hours. First semester. Three units.

#### 8. American Politics.

Underlying principles and practical methods of federal, state, and municipal government and politics; platforms and organization of political parties; modern methods of expert government and administration; legislative reference work, and bureaus of public efficiency. Three hours. Second semester. Three units.

#### 9. Labor Problems.

Origin of the labor problem and history and growth of labor organizations. Economic and social condition of the working classes in the United States and Europe today, including study of child and woman labor; immigration and its relation to wages and the standard of living of American workmen; sweating system; poverty and unemployment. Organized labor vs. organized capital; strikes and lockouts; closed vs. the open shop; collective bargaining; employers' organizations. Political and legal aspects; use and abuse of the injunction; police power of the state; the laborer in politics. Offered in 1915-16 and alternate years. Three hours. First semester. Three units.

10. Economic Reform Movements.

This course logically follows Social Science 9. The labor question with emphasis upon the constructive side; the chief proposals for the solution in America, Europe, and Australia; profit sharing; cooperation; industrial education; compulsory arbitration; labor legislation in the United States. Offered in 1915-16 and alternate years. Three hours. Second semester. Three units.

12a, 12b. Seminar in Arizona Problems.

For advanced students. One to three hours. Both semesters.

13, 14. Elementary Accounting.

An introductory study of simple accounts; the general principles of accounting, meaning of the balance sheet and other reports furnished by firms and corporations, and accounting problems incident to efficient business management. Concrete examples, with special attention to farm, engineering, and cost accounting. Open to all college students. Two hours. Both semesters. Two units, each semester.

15. Advanced Accounting.

Offered in 1916-17 and in alternate years. Two hours. First semester. Two units.

16. Municipal Problems and Public Finance.

The city in its economic, political, and social aspects. Open to those who have had Social Science 1, 2, 7, 8. Offered in 1916-17 and alternate years. Three hours. First semester. Three units.

18. Agricultural Economics.

Business aspects of rural life; capital and labor as applied to farming, irrigation, forestry, and mineral lands; agricultural banking and credit; buying of supplies and marketing of products; the public domain, state and national. Students of agriculture, who have not taken the work in Social Science 13, covering agricultural accounting, will be given in this course a simplified system of farm accounts. Three hours. First or second semester. Three units.

19. Money and Banking.

Functions of money and its relation to credit institutions; monetary system of the United States; theory and history of

banking; function of the savings bank, the trust company, the clearing house; history of American finance; financial crises in their relation to our present currency and banking systems; examination of the principal banking systems of the world for the purpose of finding ideas which would render the American system more nearly conformable to our growing financial and commercial needs. Open only to Juniors and Seniors who have had at least one year of Social Science. Three hours. First semester. Three units.

21, 22. Principles and Economics of Mining.

Especially for students of mining engineering, and given jointly with the Department of Mining Engineering. Same as Mining 5, 6. Not open to students who have had Social Science 5 and 5a. Offered in 1916-17 and alternate years. Three hours. Both semesters. Three units, each semester.

BUSINESS COURSES IN THE UNIVERSITY

The University now offers two courses in Business, Economics, Commerce, and Finance; a two-year course in practical Business Economics leading to a certificate; and a four-year course leading to the degree of Bachelor of Science in Commerce.

The two-year course in Business Economics is offered especially for those high school graduates who wish to prepare for business life and who cannot take a four-year course in commerce. Emphasis is placed upon the more practical phases of business training. Any subject in the two-year course will be accepted for full credit in the four-year course. One of the valuable features of this course consists of talks given by business men to the students. In the past, talks have been given by men who have had experience in business administration, organization, real estate, fire insurance, life insurance, salesmanship, banking, and trust business.

The four-year course in Business Economics, leading to the degree of Bachelor of Science in Commerce, is offered to meet the growing demands of the business world for men who are equipped with technical knowledge of finance, business organization, and administration. In addition to all that is given in the two-year course, the student is required to elect science or mathematics, and more foreign language. Entrance requirements are the same as for the degree of Bachelor of Arts.



## SPANISH

(See Romance Languages)

## ZOOLOGY

PROFESSOR VORHIES AND MR. BROWN

For introductory course in Zoology, see Biology 1, 2, which is prerequisite to advanced work in the Department of Zoology.

## 3. Invertebrate Zoology.

The morphology, natural history, and phylogeny of the invertebrates, with laboratory studies on members of each Phylum. Two lectures and two laboratory periods. First semester. Four units. Fee \$3.00.

## 4. Vertebrate Zoology.

The morphology and phylogeny of vertebrates, with such attention to natural history and local fauna as the needs of the class demand. Dissection of a selected series of Chordate types. Recommended especially for pre-medical students. Two lectures and two laboratory periods. Second semester. Four units. Fee \$3.00.

## 5, 6. Entomology.

The structure and relationship of insects with especial attention to classification and economic aspects of the subject. Arizona insects will provide the bulk of the material for this course, and attention will be given to local insect pests to as great an extent as conditions make possible. The aim is to prepare the student to meet an insect problem in an intelligent manner. One lecture and two laboratory periods. Three units. Fee \$2.00, each semester.

## 7. Embryology.

Germ cells, oogenesis, and spermatogenesis, fertilization; early development of frog and chick. Some practice will be given in the technique of preparing, staining, and mounting microscopical preparations. Not given in 1916-17. Two lectures and two laboratory periods. First semester. Four units. Fee \$3.00.

## 8. Ornithology.

A course designed to give the general student an acquaintance with Arizona birds, and sufficient knowledge of birds in general to enable him to learn readily those of any locality. No prerequisite. Not to be given in 1916-17. One lecture and one laboratory period or field trip. Second semester. Two units. Fee \$3.00.

## 9, 10. General Physiology.

Designed for those wishing a general rather than a highly technical knowledge of the elementary facts concerning the structure and functions of the human body, and for students of domestic science. So far as possible for the general student unacquainted with technical laboratory manipulations, the work is based on laboratory experiment and observation. Three units, each semester. Two recitations and one laboratory period. No prerequisites, but general biology or a knowledge of elementary chemistry very desirable. Fee \$1.50 each semester.

## EXTENSION DEPARTMENT

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The University operates a system of extension lectures under an appropriation made by the legislature. The purpose of the Extension Department is to carry some of the benefits and satisfaction of higher education to a large number of persons who are unable to attend regular courses at the University. This work is carried on through correspondence, by lectures and public discussions, and by the distribution of publications.

**Correspondence**—The University offers opportunity for home study through correspondence courses in the following subjects: agriculture, architecture, astronomy, botany, civil engineering, education, English, French, geology, German, history, mathematics, mineralogy, mining and metallurgy, philosophy, physics, and Spanish. Two types of correspondence courses are offered, formal and informal. The formal course is designed to be the equivalent of some University course, and for the satisfactory completion of such a course, University credit is given. When credit is desired, the student is required to prepare definite assignments and to pass an examination. The informal course is designed for those not desiring credit. Although such courses are carefully directed by the instructor in charge, they follow no hard and fast plan but are varied somewhat to meet the needs of the individual student.

Full information regarding correspondence work may be obtained by addressing the Correspondence Secretary, University of Arizona, Tucson.

**Extension Lectures**—The University responds to requests for lectures in the various fields of its work, giving these lectures without cost for service to the community. In some cases the community, however, provides transportation and entertainment of the speaker. Schools, clubs, and other organizations desiring speakers for special occasions, for single lectures on some topics, or for a series of lectures, should address correspondence to the office of the President of the University. Ample time should be allowed for the appointment of dates and for the adjustment of all details.

The Extension Department offers its services also to schools, clubs, or other organizations interested in debating and public discussions. Considerable material on all current questions is available and may be secured upon request.

Wherever possible from the facilities at hand, the University will gladly send information either through correspondence to any making specific inquiries concerning matters relating to personal and public welfare, hoping through its large library and its highly trained specialists to place its advantages at the service of all the people of the State.

# AGRICULTURAL EXPERIMENT STATION

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Rufus B. von KleinSmid, Sc. D., President of the University.  
Robert H. Forbes, Ph. D., Director  
John J. Thornber, A. M., Botanist  
Johannes C. Th. Uphof, Assistant Botanist  
Albert E. Vinson, Ph. D., Biochemist  
Clifford N. Catlin, Assistant Chemist  
George E. P. Smith, C. E., Irrigation Engineer  
Arthur L. Enger, B. S., Assistant Irrigation Engineer  
George F. Freeman, B. S., Plant Breeder  
Walker E. Bryan, M. S., Assistant Plant Breeder  
Stephen B. Johnson, B. S., Assistant Horticulturist  
Richard H. Williams, Ph. D., Animal Husbandman  
Walter S. Cunningham, B. S., Assistant Animal Husband-  
man  
Austin W. Morrill, Ph. D., Entomologist  
John F. Nicholson, M. S., Agronomist  
H. Claude Heard, B. S. A., Assistant Agronomist  
Helen M. A. Miller, Secretary of Experiment Station  
Mrs. A. M. Leeson, Stenographer

## ORGANIZATION AND WORK

The Agricultural Experiment Station is legally appurtenant to the College of Agriculture which in turn is a department of the University organization. The purpose of the Agricultural Experiment Station is to aid "in acquiring and diffusing useful and practical information on subjects connected with agriculture, and to promote scientific investigation and experiments respecting the principles and applications of agricultural science."

The activities of the Experiment Station include research and experimentation in Agriculture, Horticulture, Animal Husbandry, Botany, Entomology, Plant Breeding, Chemistry and Irrigation Investigations, the whole or a major portion of the time of one or more members of the station staff being de-



voted to each of these lines of station work. Provision is also made for Farmers' Institutes and for advisory work in Farm Management, by means of which the results of experiments and investigations in agriculture are carried to farmers throughout the State.

Owing to wide variations in agricultural conditions in Arizona it has been found of advantage to distribute the various branches of station work with reference to conditions required for its satisfactory accomplishment as follows:

The administrative offices, and the botanical, plant breeding, chemistry, horticultural, animal husbandry, agronomy, and irrigation laboratories are maintained at Tucson in the University buildings. From this base of operations the three great agricultural districts of the State—Salt River Valley, the Lower Colorado Valley, and the Upper Gila district are conveniently accessible for field work and observations.

The main Experiment Station farm has been maintained in Salt River Valley, which is intermediate in elevation and in mean yearly temperature with respect to the irrigated valleys of southern Arizona. Results obtained at this point are therefore capable of general application in the southern part of the State.

The date-palm orchard, conducted in co-operation with the U. S. Department of Agriculture, is situated in the alkaline district at Tempe where successful experimentation with this palm has been of great value in demonstrating a use for extensive areas of alkaline land in the Southwest.

The demonstration farm near Yuma, in the fertile valley of the Colorado River, has also afforded a succession of object lessons to the local public and has contributed information concerning, crops, agricultural methods, and markets for this rich region.

Experiments in dry farming have been initiated on a new tract secured for the purpose near Cochise, in Sulphur Spring Valley; in the neighborhood of Snowflake in Navajo County, and near Prescott, Arizona, in localities typical of large areas. The grazing range reserve, also, for the study of worn-out range country, with a view to its reclamation, is conducted in a typical district of intermediate elevation near Tucson, in co-operation with the U. S. Department of Agriculture.

The University farm and a plant breeding garden rented of the Evergreen Nursery, afford facilities for study and experi-

mentation at Tucson. Laboratories, greenhouses, and small gardens on the University grounds serve a similar purpose. The results of Experiment Station work are published at intervals in the bulletins and reports of the station. The longer and more technical bulletins and annual reports state in considerable detail the results of investigations as they mature. *Timely Hints for Farmers*, which are brief non-technical writings, are issued at the time when they will be most useful, are written in plain language, and presented in popular form. By means of an extension publicity service, still further circulation is given to matters of agricultural interest to the newspapers of the State.

Inasmuch as for years past the mailing list has enabled the station to reach 50 per cent or more of the farming population in Arizona, it is not surprising that the effects of station work are now generally in evidence throughout the State, more particularly in our irrigated southern valleys.

The Agricultural Extension service, combining state and federal endowments for agricultural extension work, is effectively carrying agricultural knowledge into practice among Arizona farmers.

Supplementing the federal appropriations and for the purpose of more liberal endowment of agricultural research, education, and extension within Arizona, the second State legislature appropriated \$87,758.82 for the two years beginning July 1, 1915, as follows:

Equipment of new Agriculture Building at the University .....	\$ 11,718.82
Operation of facilities for reference and research....	9,860.00
Dry farming experiments .....	21,780.00
Intensive farming and date-palm studies near Yuma and Tempe .....	7,000.00
Horticultural investigations .....	1,400.00
Underflow water investigations .....	4,000.00
Plant introduction and breeding .....	6,000.00
Printing and binding .....	6,000.00
Extension Service .....	10,000.00
Salt River Valley Farm .....	10,000.00
	<hr/>
	\$87,758.82

In addition to these items the sum of \$22,000 was appropriated for agricultural instruction at the University for the biennium beginning July 1, 1915.

The Agriculture Building, which was completed September, 1915, will offer ample room for research, educational work and extension in agriculture, and will afford an attractive center for the agricultural activities of the State in time to come.

With this endowment and with an organization which brings the agricultural work of the University into close contact with the farming interests of the State, "the farmers' college" has entered upon an epoch of increasing usefulness to the growing agricultural interests of Arizona.

# AGRICULTURAL EXTENSION SERVICE

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Rufus B. von KleinSmid, Sc. D.	President of the University.
Robert H. Forbes, Ph. D.	Olive Road
Dean, College of Agriculture.	
Stanley Fletcher Morse, B. A. S.	127 E. Third St.
Superintendent State Leader, *County Farm Advisor Work.	
George Wallace Barnes, B. S.	810 E. Sixth St.
Livestock Specialist.	
*Leland Stanford Parke, B. S.	Y. M. C. A. Bldg.
State Club Agent.	
*Lyman D. La Tourrette, M. S. A.	Phoenix, Ariz.
County Club Supervisor.†	
*Edith Charlton Salisbury	Phoenix, Ariz.
Home Economics Specialist.†	
*Estmer W. Hudson	Tempe, Ariz.
Egyptian Cotton Specialist.	
*James Alexander Armstrong, B S.	Phoenix, Ariz.
County Farm Advisor, Maricopa County.	
*Arthur Lee Paschall, B. Agr.	San Simon, Ariz.
County Farm Advisor, Cochise-Santa Cruz Counties.	
*Charles R. Fillerup, B. P. I., D. B.,	Snowflake, Ariz.
County Farm Advisor, Navajo-Apache Counties.	
*Alando B. Ballantyne, B. S.	Thatcher, Ariz.
County Farm Advisor, Graham-Greenlee Counties.	
Foster Towne Parker	Y. M. C. A. Bldg.
Secretary.	

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\*Employed in cooperation with the U. S. Department of Agriculture.

†Temporarily employed.

## ORGANIZATION AND WORK

The Agricultural Extension Service as at present organized is a division of the College of Agriculture of the University of Arizona, having the same relation to the College of Agriculture as the Agricultural Experiment Station. The purpose of the Agricultural Extension Service is to give "instruction and practical demonstration in agriculture and home economics to persons not attending or resident in said college," including principally farmers and stockmen and their families, and new settlers and their families throughout the State. The organization of the Agricultural Extension Service was made possible by the Smith-Lever Act, which was passed by Congress and approved on May 8, 1914. The work was started in Arizona on July 1, 1914. Funds for carrying on the agricultural extension work are provided by the appropriations of the Smith-Lever Act; appropriations of the State Legislature for the University Extension Service; appropriations made by the County Boards of Supervisors for the support of county farm advisors; and contributions from railroads and farmers' organizations; and also apportionments from the U. S. Department of Agriculture, in cooperation with which much of the agricultural extension work is being carried on.

The specific lines of work which are being conducted by the Agricultural Extension Service include the following:

### County Farm Advisor Work.

Properly qualified men who have been technically trained in agriculture and who have had practical farming experience are located in various counties in the State which have agreed to contribute funds to the support of the work, and are employed in cooperation with the U. S. Department of Agriculture as county farm advisors to devote their entire time to the county or group of counties within which they are placed. These county farm advisors are at the service of all the farmers in the county and conduct their work largely through definite plans known as projects. This work is carried on in cooperation with and working through farmers' local and county organizations, generally known as farm improvement associations. In carrying on their various activities the county farm advisors are assisted by the extension specialists and such other specialists of the College of Agriculture as may be sent out under the auspices of the Extension Service. The intention is to locate a county farm ad-



visor in every agricultural county or district in the State as rapidly as funds will permit.

### Boys' and Girls' Club Work.

Training the boys and girls of to-day to become the farmers and farmers' wives of tomorrow is the work of this department. Under the supervision of the State Club Agent the following Boys' and Girls' Clubs are being organized throughout the State: Corn, grain, sorghum, cotton, canning, pig, and poultry. This work is carried on in cooperation with the U. S. Department of Agriculture. The members of these clubs compete with each other for local and State prizes. That this work is largely educational in character will be seen from the fact that its purpose is to interest the boys and girls in better methods of doing farm and household work, to teach them how to keep simple accounts, to instill in them the idea of cooperation, and to instruct them how to write concise, thorough reports on the work that they have accomplished. The demand for the Boys' and Girls' Clubs is exceeding the facilities for giving service.

### Livestock Extension

This line of work is carried on by the Livestock Specialist, and has for its object the assisting of farmers and stockmen to improve their livestock business. This work is divided into definite projects, as follows: (a) Dairy Improvement; (b) Swine Development; (c) Range Cattle Improvement. As rapidly as funds are available this work will be enlarged and assistants added to meet the many demands which it is at present impossible to handle.

The other lines of extension work are too numerous to attempt to explain here, but include: Egyptian Cotton Extension, which is being carried on principally in the Salt River Valley under the direction of the Egyptian Cotton Specialist in cooperation with the U. S. Department of Agriculture for the purpose of establishing the Egyptian cotton industry; Home Economics Extension, which is being conducted among the rural housewives of the State for the purpose of increasing household efficiency and making home life pleasanter; Movable Schools, which consist of three-day courses of instruction for farmers and their families held in different parts of the State; Farmers' Short Course, which is a course of practical instruction held at the University for a period of two weeks for farmers, who come from all over the State. The Weekly Press Letter is sent regularly to all the newspapers and

farmers' organizations in Arizona, in addition to a quantity of other publicity and extension circulars. Exhibits and judges are sent to fairs; speakers are provided for farmers' meetings; and specialists are sent to give advice on special farming problems.

The Agricultural Extension Service is cooperating in this work with the Arizona Farm Improvement Association and more than 50 local farmers' organizations throughout the State which are affiliating with the State Association. It is a physical impossibility for the extension workers to handle all of this important work, and the intention is to enlist the farmers themselves in carrying on this work under the direction of the Agricultural Extension Service.

# ARIZONA STATE BUREAU OF MINES

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Rufus B. von KleinSmid, Sc. D., President of the University

Charles F. Willis, S. B., Director

A. M. Heckman, Secretary

Frank L. Culin, Jr., B. S., Mining Engineer

P. E. Joseph, B. S., Metallurgist

J. D. Arozena, Assayer

By an Act of the legislature of 1915, the Arizona State Bureau of Mines was authorized, the affairs of which are placed under the direction of the Board of Regents of the University of Arizona. The Bureau of Mines is a mining experiment station, to deal with the mining, metallurgical, and geological problems of the State.

The Bureau compiles and publishes statistics of all kinds regarding Arizona mines, such as production, values, types of machinery, efficiency reports, methods, mill statistics, and other data of interest and importance to every operator in this State, as well of other states. A bibliography and library of all literature pertaining to Arizona mining are of obvious utility.

It is aimed to deal experimentally with Arizona problems of wet, dry, and electrostatic concentration, dry placer and flotation methods. Qualitative rock determinations, where the samples sent are given a petrographical or mineralogical name, are made free.

The Bureau of Mines aims to educate the miner and prospector by a series of lectures, articles in daily and weekly mining papers, and publication of items of interest. The employer as well as the miner should profit by this educational work. The Bureau will offer to the miner and prospector a place for determining samples; practical advice and instruction and education on the economic side—and office of exchange and information. The same data will be of service to those outside of the state who desire information on Arizona mining.

Assays of ores and minerals are made for prospectors and miners of Arizona and for others at fixed rates established by

law. Accuracy and excellence of work are considered of more importance than pecuniary profits. All assays are made in duplicate, and if not accordant, are repeated. The money received for assaying is deposited monthly to the credit of the Assay Fund, which is used to pay the assayer and the cost of material and apparatus.

Bulletins are issued weekly by the State Bureau of Mines for the purpose of informing the public as to the resources of the state, better methods of prospecting, economic questions, etc. These bulletins may be obtained by applying to the director, Arizona State Bureau of Mines.

### **RATES FOR ASSAYING AND CHEMICAL DETERMINATIONS**

In accordance with the Act of the Legislature of Arizona, approved March, 1897, and amended in March, 1899.

#### **COMMON ASSAYS AND CHEMICAL DETERMINATIONS**

One element only:

Gold, or silver, or copper, or, lead, or iron, or insoluble....	\$ 1.00
Zinc, or calcuim, or magnesium, or sulphur, or manganese .....	1.50
Silicon or chlorine .....	2.00
Combinations:	
Gold and Silver .....	1.00
Copper and iron, or lead and iron .....	1.50
Insoluble, copper and lead .....	2.00
Insoluble, lead and iron .....	2.00
Insoluble, zinc and iron .....	2.50
Insoluble, lead, copper, and iron .....	2.50
Gold, silver, copper and lead .....	2.50
Gold, silver, copper, iron and insoluble .....	2.50

#### **SPECIAL CHEMICAL DETERMINATIONS**

One element only:

Aluminum, or tungsten, or barium, or chromium .....	3.00
Cadmium, or tin, or arsenic, or bismuth, or antimony, or titanium, or sodium, or potassium, or uranium, or phosphorous .....	4.00
Nickel, or cobalt, or molybdenum, or vanadium .....	5.00

#### **CHEMICAL ANALYSIS**

Coal and coke analysis, giving moisture, volatile combustion matter, fixed carbon and ash .....	5.00
The same, including determination of sulphur and phosphorus .....	7.50

Silicate analysis .....	15.00
Cement analysis (chemical) .....	15.00
Cement analysis (mechanical) .....	2.50
Cement tests for strength and soundness by the Department of Civil Engineering .....	10.00

## CONSIGNMENTS AND REMITTANCES

Samples, ores, and other consignments should be shipped to the Bureau of Mines, Tucson, Arizona. Small quantities may best be sent by parcels post; larger quantities by freight or express.

All assays, chemical determinations and chemical analyses except gratuitous qualitative tests mentioned elsewhere must be paid for in advance. Remittances should be made by post-office money order, Wells Fargo money order, bank draft, or check on a Tucson bank, payable to the University of Arizona.



# STATE SCHOOL FOR THE DEAF

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The State School for the Deaf is affiliated with the University and under its direction. The school has its own buildings adjacent to the University campus, suitably equipped for the home comfort and the academic and industrial instruction of the children in attendance.

## OBJECT OF THE SCHOOL

It is the object of the school to give children that are too deaf to be educated in the public schools, a liberal education, to restore them, as nearly as possible, to a place in society beside their hearing brothers and sisters, and to equip them in such a way as to render them able to make their own way in the world.

## COURSE OF STUDY

The course of study corresponds to that of the public schools of the State. Any boy or girl who shows the mental capacity, will be given the necessary preparatory work to enter college. At the same time, emphasis is laid on domestic science, carpentry, and gardening. Every girl is taught plain sewing and cooking, and the boys receive instruction in carpentry and gardening.

Teaching speech and lip-reading, occupy a very important place in the work of the school. Every child coming to the school will have the opportunity to be taught to speak and read the lips; finger spelling and manual signs have no place in the method of instruction.

## TERMS OF ENTRANCE

The school is free to children whose parents or guardians are residents of this State. The academic year runs from September 22 to June 1. Parents must furnish necessary clothing and transportation for their children. During the summer recess, all children return to their homes. Application for admission is made to the Superintendent of Public Instruction, Phoenix.

Further information concerning the school will be furnished upon communicating with the Principal.

## OFFICERS AND TEACHERS

Howard Griffin, Principal  
Julia R. Bateman, Teacher  
Eleanor C. Jones, Teacher  
Sabra C. Bradley, Teacher

Ernest Russell, Instructor in  
Manual Arts, Supervisor of  
Boys.  
Bertha Griffin, Matron  
Ruth Davis, Supervisor of Girls

## DEGREES CONFERRED JUNE 1, 1915

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### Bachelor of Arts

Bessie Jewell Barkley  
Mabel Ruth Carter  
Esther May Curry  
Catherine Gertrude Duffy  
Alice Patton Lawson  
Julia Rockfellow

### Bachelor of Science

Walter Martin Brewer  
Agnes Conrad  
Lawrence Richard Jackson  
Leon Henri Strong, B. A.

### Bachelor of Science in Agriculture

Verne Gerald LaTourrette

### Bachelor of Science in Commerce

Normal Clifton Hayhurst  
Eugene Read Lynch

### Bachelor of Science in Electrical Engineering

Herbert Rolland Aylworth

### Bachelor of Science in Mining Engineering

Frank Lewis Culin, Jr.  
Franklin Alfred Luis  
Percy Frank Minister  
Ralph Lee Rigg

### Master of Science in Civil Engineering

Alfred Dominguez Micotti, B. S. C. E.

## HONORARY DEGREES

### Master of Arts

John D. Loper

### Doctor of Laws

Edward Kent

## HONORS AND PRIZES

### HONOR SCHOLARSHIPS

Honorary scholarships are conferred annually for the purpose of encouraging scholarship that is sound at every point. They are non-competitive, awarded to every student attaining a required proficiency. Freshmen reaching the required standard of excellence receive honorable mention; Sophomores, Juniors, and Seniors are recognized as Sophomore, Junior, and Senior Scholars respectively, and students carrying the work of both the Junior and Senior years at this standard, are known as the University of Arizona Scholars. In the year 1914-15 the Honorary Scholarships were awarded as follows:

University Scholar: Percy Frank Minister

Senior Scholar: Alice Patton Lawson

Junior Scholars: Mary R. Brinton, Catherine S. Hoy, Carl Clark, J. Wilson Getsinger, J. Preston Jones, Watson W. Pickrell

Sophomore Scholars: Mabel Odell, Josephine Waters, Albert Crawford, Fred W. Fickett, Leonard Klein

Honorable Mention: William Conley, Jesse Woolf, Helen Vanderdoes, Philip Clemons, Fred Gray

### THE DRACHMAN PRIZES IN DEBATING

To stimulate interest in public questions, Mr. Harry A. Drachman, of Tucson, offers to the students of the University two annual cash prizes of \$25 and \$15 respectively. During the academic year 1914-1915 the prizes were offered for the two best debates. They were awarded as follows:

First Prize, Grady Gammage

Second, Prize, Benjamin McClure

### \*THE TROUTMAN MEDALS IN CHEMISTRY

Dr. George D. Troutman, of Tucson, to stimulate interest among the students in the chemistry of pure foods, has in the past offered two medals, of gold and silver, as prizes for superior work in chemistry. In the year 1914-1915 these medals were awarded as follows:

The Gold Medal, Albert Crawford, Jr.

The Silver Medal, Leonard Klein

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\*Not offered after 1914-15

**COUNTY SCHOLARSHIPS**

Albert Crawford, Yavapai County  
C. Deane Haughtelin, Yuma County  
Albert A. Zeitlin, Cochise County  
Winifred O. Smith, Gila County  
Robert Garing, Coconino County  
Priscilla Phillips, Graham County  
Kenneth E. Comstock, Maricopa County  
Tillie Kaufman, Pima County  
John O'Keefe, Santa Cruz County  
Franklin Bonelli, Mohave County  
Temple Penrod, Navajo County

**BENNETT SCHOLARSHIP**

Elsie Windsor

**COLLEGIATE CLUB SCHOLARSHIP**

Inez Esther Thrift

**RECENT FOUNDATIONS**

Hereafter Dr. Merrill P. Freeman offers two scholarship medals, one for men and one for women. These medals are awarded by the Committee on Administration: In the case of men, for scholarship, fondness for and success in manly outdoor sports; qualities of manhood—truth, courage, devotion to duty, sympathy, kindness, unselfishness and fellowship; manifestations of moral force of character and of qualities of leadership. In the case of women, for scholarship, interest and service in student enterprises; qualities of womanhood—truth, courage, devotion to duty, kindness, unselfishness and fellowship; manifestations of force of character and of qualities of leadership.

In memory of his father, Ex-Governor L. C. Hughes, Mr. John T. Hughes offers a scholarship of \$50, to the student who submits the best treatise on some legal topic.

Dr. Curtis Howard of Columbus, Ohio, offers a prize of \$20 to be known as the Ella Howard Estill prize to the student who makes the highest record in the history of art.

**THE MILITARY PRIZES**

Captain Hiram M. Powell, late Commandant of Cadets, and Mr. Merrill P. Freeman, of Tucson, sometime Regent of the

University, have annually presented prizes to the best drilled students,—a saber, the gift of Captain Powell, to the most efficient commissioned officer, and a medal, the gift of Mr. Freeman. Since the death of Captain Powell, the gift of the saber is continued by Mrs. Powell. In the year 1913-1914 the requirements for the Freeman medal were increased, the recipient being proficient not only in the military department but also in other work in the University and of high standing in character and conduct. The new requirements for the Freeman medal, are stated above.

Colonel George LeRoy Brown, head of the Military Department, offers a medal to the most efficient non-commissioned officer, and another for the best drilled private.

Captain Sidney F. Mashbir, of the National Guard, has offered a gold medal to the cadet making the highest score at long range target practice during the coming year.

Senator Andrew J. Martin offers a prize of fifteen dollars for the cadet having best attendance record and best average score at rifle practice.

In the year 1914-15 the military prizes were awarded as follows:

The Freeman Medal, for general scholarship, deportment, and military excellence,

Richard S. Lindsley

The Powell Saber, for the most efficient commissioned officer,

Francis C. Mack

The Brown Medal, for the most efficient noncommissioned officer,

George I. Eberle

The Brown Medal for the best drilled private,

Henry Woo

Membership medal, N. R. A., for the best score at long range rifle practice,

Robert S. Garing



# MILITARY ORGANIZATION

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Adjutant, First Lieutenant, Francis R. Duffy  
 Quartermaster, Second Lieutenant, Wendell T. Robie  
 Ordnance Officer, Second Lieutenant, John Burns  
 Quartermaster Sergeant, Norman Abell  
 Color Sergeant, William H. Hendry  
 Color Sergeant, William LeB. Jenney

COMPANY A	COMPANY B	COMPANY C	COMPANY D
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## CAPTAINS

H. H. Grimshaw	C. U. Pickrell	C. Z. Leshar	D. S. Brown
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## FIRST LIEUTENANTS

H. H. Mayhew	F. G. McClure	Asa Porter	F. W. Fickett
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## SECOND LIEUTENANTS

H. H. Harders	J. H. Gardner	E. C. Munro	C. L. Renaud
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## FIRST SERGEANTS

J. V. Hammels	H. D. Carpenter	E. E. Russell	G. L. Eberle
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## SERGEANTS

F. J. McSherry	A. Bettwy	R. S. Garing	Carter Porter
H. C. Westover	H. E. Turvey	E. H. Estill	J. A. Woolf
Wm. LeB. Jenney	W. H. Hendry	Richard Meyer	G. W. Seeley

## CORPORALS

C. H. Howard	LeR. R. Hanson	R. W. Eskew	J. F. Barnard
R. H. Jacobus	L. W. Jaycox	T. S. Bayze	G. V. Hays
W. H. Westover	F. A. Ronstadt	M. Barth	O. H. Swaney

# REGISTER OF STUDENTS

## \*REGULAR STUDENTS

NAME	†UNITS	‡COURSE
Abell, Norman .....	23	...B. S. .... Tombstone
Acker, Nydia .....	66	...B. S. (H. E.) .... Prescott
Adams, I. C. E. ....	39	...A. B. .... Bisbee
Ames, Edward W. ....	122	...B. S. .... North Easton, Mass.
Arozena, Joe De. ....	137	...B. S. (Mining) .... Texas
Baker, Lillian D. ....		...G. .... Appleton, Wis.
Balderas, Charles .....		...U. .... Tucson
Barnard, Justin F. ....	51	...B. S. .... Concord, N. H.
Bates, Clemmin A. ....		...B. S. (H. E.) .... Cleveland, Tenn.
Bateman, Juliana R. ....	2	...U. .... Tucson
Bayze, Thomas, Jr. ....	10	...B. S. (Agr.) .... Nogales
Beach, Charles P. ....	71½	...B. S. (Agr.) .... Los Angeles, Cal.
Behr, Otho M. ....	15	...B. S. (Chem.) .... Switzerland
Bedford, Arthur H. ....	31	...B. S. (Agr.) .... New Zealand
Beck, Florence .....		...G. .... Tucson
Benson, Robert R. ....	32	...A. B. .... Pasadena, Cal.
Benzie, Inez M. ....	116	...A. B. .... Tucson
Bertelsen, E. E. ....	6	...B. S. .... Tempe
Bettwy, Andrew .....	13	...A. B. (Law) .... Altoona, Pa.
Binkhorst, A. ....		...G. .... Tucson
Bird, Ruth .....	16	...A. B. .... Tucson
Bonelli, Franklin H. ....		...B. S. .... Kingman
Brackenbury, Richard A. ....	34	...B. S. .... San Diego, Cal.
Brinton, Mary R. ....	116	...A. B. .... Tucson
Brisley, Harold .....	51	...B. S. (Agr.) .... Prescott
Brooks, S. E. ....	14	...B. S. (E. E.) .... Phoenix
Brown, Mrs. E. Y. ....	33	...B. S. (Agr.) .... Cleburne, Tex.
Brown, Katherine .....	24	...A. B. .... Cleburne, Tex.
Brown, Dudley S. ....	75½	...B. S. (Agr.) .... Tucson
Brown, Ruth Olive. ....	93	...A. B. .... Tucson
Browne, Myron G. ....	40	...A. B. (Law) .... Tucson
Burns, John .....	77	...B. S. .... Berkeley, Cal.
Bucholtz, Bloomah .....		...U. .... Los Angeles, Cal.
Burrell, Alden F. ....	7	...B. S. (Agr.) .... Portland, Ore.
Burhoe, Mary E. ....	3	...U. .... Chicago, Ill.
Campbell, Helen E. ....	44	...A. B. .... Tucson
Carpenter, Harold S. ....	51	...B. S. .... Vekol, Ariz.
Case, Harvey W. ....	19	...B. S. .... Phoenix
Casebeer, Lloyd .....	11	...A. B. .... Ashland, Ore.
Chapin, Elsa .....		...G. .... Tucson
Chapman, Edith .....	63	...A. B. .... Bisbee
Chapman, Mrs. John O. ....	3	...B. S. (H. E.) .... Tucson

\*Regular students have met the entrance requirements.

†Units completed at close of first semester.

‡U indicates unclassified; G, graduate student.

NAME	UNITS	COURSE	
Chapman, John O.....	48½	B. S.	Tucson
Clark, Carl.....	137½	B. S. (Agr.)	Yuma
Clarkson, Clyde E.....	39	B. S. (Agr.)	Albia, Ia.
Clawson, Leslie.....	35	B. S. (Agr.)	Thatcher
Clemons, Phillip De R.....	19	A. B.	El Paso, Tex.
Clements, Mildred M.....		U.	Tucson
Cole, David, Jr.....	66½	B. S. (M. E.)	El Paso, Tex.
Colodny, Pauline.....		U.	Tucson
Comstock, Kenneth.....	19	B. S. (Chem.)	Phoenix
Condron, Albert H.....	99	B. S. (C. E.)	Redwood City, Cal.
Conrad, Agnes.....		G.	Madison, Wis.
Crawford, Albert, Jr.....	101½	B. S. (Chem.)	Prescott
Cruce, Lorena J.....		A. B.	Ardmore, Okla.
Culin, Frank L., Jr.....		G. (Mining)	Tucson
Cummings, Byron.....		G.	Tucson
Curry, Corlande B.....	47	A. B.	Tucson
Curry, Mossalena.....		B. S. (H. E.)	Tucson
Dale, Marion.....	11	A. B.	Murray, Ky.
Davidson, Edna.....		U.	Tucson
Douglass, Mrs. A. E.....		G.	Tucson
Downey, Roland.....	26	B. S. (Agr.)	Phoenix
Duffy, Frances.....	54	B. S. (C. E.)	Nogales
Durazo, Alyandro L.....	14	B. S. (Agr.)	Tucson
Eberle, George.....	53	B. S. (Agr.)	San Fran., Cal.
Enger, Mrs. Garth.....	10	B. S. (H. E.)	Tucson
Estabrook, M. A.....		A. B. (Law)	Lowell, Mass.
Eskew, Roderick.....	15	A. B.	Charlestown, W. Va.
Estill, Edward H.....	45	B. S.	Tucson
Estill, Mary H.....	46	B. S.	Tucson
Estill, Howard W.....	28	G. (Chem.)	Tucson
Faye, Marjorie.....	3	U.	Brookline, Mass.
Feldman, Mrs. Louis.....		G. (H. E.)	Santa Monica, Cal.
Feldman, Louis.....		B. S. (Agr.)	Santa Monica
Fickett, Fred W.....	99½	A. B.	Tucson
Fickett, Webster L.....	122½	B. S. (E. E.)	Tucson
Fields, Josephine M.....	17	A. B.	Liberty
Fisk, F. Gilmore.....	68	B. S. (Agr.)	Tempe
Foster, Florence.....	7	G.	Tucson
Fletcher, Archibald.....		B. S.	Nogales
Freeman, Mrs. Stella.....	2	B. S. (H. E.)	Tucson
Gammage, Grady.....	120½	A. B. (Law)	Tucson
Gardiner, John.....	65¼	B. S. (E. E.)	Tucson
Garing, Robert S.....	64	B. S. (Agr.)	Flagstaff
Getsinger, Jos. W.....	125¼	B. S.	Phoenix
Gibbs, Gladys V.....	113	B. S. (Physics)	Tucson
Gibbs, Paul H.....	17	B. S. (Biology)	Tucson
Gilbert, Ira N.....	13	B. S. (Agr.)	Tucson
Gilmore, Nell E.....		U.	Uniontown, Pa.
Gotthelf, Minnie A.....		U.	Tucson
Goldberg, Harold.....	18	B. S. (Com.)	Phoenix
Grabe, William E.....	92¾	B. S. (E. E.)	Tucson
Gray, Mrs. Geo. F.....		U.	Bowling Green, O.

NAME	UNITS	COURSE	
Gray, Hollis V.....	18	B. S. (Agr.) .....	Tempe
Gray, Fred A.....	21	B. S. (E. E.) .....	Oakland, Cal.
Gregg, Wallace C.....		U. ....	Phoenix
Gregory, Harriet A.....	2	U. ....	Tucson
Griffin, Howard .....	90	B. S. ....	Tucson
Griffith, Helen .....	25	U. ....	Tucson
Grimshaw, Henry H.....	115 $\frac{1}{4}$	B. S. (Agr.) .....	Phoenix
Grossetta, Mrs. Marion W. ....	3	U. ....	Tucson
Guild, Mrs. Marilla .....	122	A. B. ....	Tucson
Halliday, Frances M. ....	34	2-3 A. B. ....	Gallapolis, O.
Hallmark, Wane .....	19	B. S. (Mining) .....	Brownsville, Tex.
Hammels, James V.....	60	B. S. (Agr.) .....	Glendale
Hankins, Martha .....	50	A. B. ....	Tucson
Hannah, Bruce .....	69	B. S. (E. E.) .....	Springfield, Mo.
Harvey, Madeline .....	2	U. ....	Long Beach, Cal.
Harvey, Marie .....	59	A. B. ....	Long Beach, Cal.
Harley, Perry H.....			Tucson, Ariz.
Haughtelin, C. Deane.....		A. B. ....	Yuma
Hanson, LeRoy .....	53	B. S. (C. E.) .....	Phoenix
Harders, Hans H. ....	95 $\frac{1}{4}$	A. B. ....	Globe
Hays, George Vinton.....	55	A. B. (Law) .....	Willcox
Haynes, Marion M.....	17	A. B. ....	Tucson
Heckman, Harold M.....	18	B. S. (Com.) .....	Ward Hill, Mass.
Hedgpeth, John A.....	116 $\frac{1}{4}$	B. S. (Agr.) .....	Phoenix
Helm, Lloyd .....	13	B. S. (M. E.) .....	Phoenix
Hendry, James W.....	31	B. S. (M. E.) .....	Tucson
Henley, Mrs. Stella.....	9	U. ....	Tucson
Herndon, James P.....	17	A. B. ....	Tucson
Hershey, Carl G. ....	19	B. S. (E. E.) .....	Phoenix
Heighton, Dorothy .....		U. ....	Tucson
Hield, Horace, H.....	87 $\frac{1}{2}$	B. S. (Mining) .....	Chicago
Hildebrandt, Clara .....	15	A. B. ....	Tucson
Hinton, Joe A.....		A. B. ....	Douglas
Hinton, Clarence G.....	41	A. B. ....	Douglas
Higgins, Thomas B.....		G. ....	Sydney, Aus.
Hoff, Gus Ralph.....	12	A. B. (Law) .....	Yorktown, Tex.
Horsley, Percy H.....		U. ....	Tucson
Houston, Hazel .....	15	A. B. ....	Tucson
Houston, Alice .....	17	A. B. ....	Tucson
Howard, E. W.....		B. S. (M. E.) .....	Marietta, Ga.
Howard, Charles H.....	55	B. S. (Mining) .....	Ashland, Ore.
Hoy, Sara Catherine .....	130	A. B. ....	Bisbee
Huddleston, Mildred F.....	63	A. B. ....	Tucson
Humphrey, Bessie .....	124	A. B. ....	Hume, Mo.
Hunsaker, Lois R.....	9	B. S. (H. E.) .....	Douglas
Hunt, Lottie I. ....		U. ....	Tucson
Hutchinson, Esther .....	2	U. ....	Tucson
Huss, Jos. V.....		B. S. (Agr.) .....	Yuma
Ikenbury, Mrs. Ethel A.....		G. (H. E.) .....	St. Joseph, Mo.
Ikenbury, Josephus .....		G. ....	St. Joseph, Mo.
Impson, Robert .....		B. S. (Agr.) .....	Bokchito, Okla.
Impson, Hiram .....	3	G. ....	Bokchito, Okla.
Irvine, Sylvan .....	8	B. S. ....	Phoenix

NAME	UNITS	COURSE	
Jacobus, Raymond H.....	58	B. S. (E. E.)	Tucson
Jacome, Josephine .....	15	A. B.	Tucson
Jay, Zella .....	16	A. B.	Phoenix
Jaycox, Lester W.....	21	B. S. (Agr.)	Phoenix
Jenney, William LeB.....	42	B. S. (Chem.)	Tucson
Jolly, Mary L.....	81	A. B.	Jerome
Jones, Allan C.....	126½	B. S. (C. E.)	Clifton
Jones, J. Preston .....	119	A. B.	Phoenix
Jones, Eleanor .....		U.	Tucson
Joseph, Mrs. Hanka Posner.....	9	U.	Russia
Joseph, Phineas H.....	19	G. (Mining)	Russia
Kaufman, Tillie .....	15	A. B.	Tucson
Keegan, Mary .....	17	A. B.	Globe
Kengla, Louis .....	28	B. S.	Tucson
Kindseth, Graham M. ....	102	B. S. (Chem.)	Red Lake Falls, Minn.
King, Ruth E.....	15	A. B.	Tucson
Kitt, Ethel .....	10	B. S.	Tucson
Kitt, Edith S.....	21	B. S.	Tucson
Klein, Leonard .....	81½	B. S. (Chem.)	Pueblo, Colo.
Kramer, Mrs. Hilda E.....	11	B. S. (Agr.)	Tucson
Kriegbaum, Lawrence L.....	122¾	B. S. (Agr.)	Avondale
Lackey, Rebecca .....		U.	Tucson
Langworthy, Georgia H.....		U.	Tucson
Langworthy, Florence .....			Pittsburg, Pa.
Lask, Harold A.....	48	B. S.	Pasadena, Cal.
Lawrence, Perry E.....	23	B. S. (C. E.)	Coquille, Ore.
Lease, Alice C.....	87½	A. B.	Tucson
Lees, Jason A.....		B. S. (Agr.)	
Leeson, Frances .....	15	A. B.	Tucson
Leshner, Charles Z.....	80½	B. S. (Agr.)	Carbondale, Pa.
Lewis, Velma .....		U.	Stillwater, Okla.
Lindsay, Edward Y.....		G.	Bloomington, Ind.
Lindsley, Richard G.....	124	B. S. (C. E.)	Tucson
Lovett, Archa E.....	14	A. B.	Shepherd, Tex.
Lowe, Maidie .....	5	U.	Yuma
Lynch, Emzy H. ....	35	B. S.	Yuma
Luis, Franklin A.....	39½	G.	Tucson
McClure, Benjamin .....	55	A. B.	Russellville, Ark.
McClure, Frank G.....	104½	B. S. (Mining)	Bisbee
McClure, Hunter .....		G. (Mining)	Piedmont, Cal.
McGowen, William R.....	50	B. S. (Agr.)	Miami
McGowen, Guy V.....	15	B. S.	Miami
McKale, J. F. ....		G.	Tucson
McNeil, Roy .....	91	B. S. (Agr.)	Tucson
McPherson, Orville .....	76½	B. S. (Com.)	Yuma
McRoberts, Margaret B.....	37	B. S.	Miami
McSherry, Frank A. ....	108	B. S. (Mining)	Gr. Jct., Colo.
Magenheimer, Floriene R.....		U.	Tucson
Maffeo, James S. ....	84¼	B. S.	Bisbee
Maldonado, Amelia M.....	16	A. B.	Tucson
Mann, Mrs. Leela.....	4	B. S. (H. E.)	Tucson



NAME	UNITS	COURSE	
Marshall, Thomas K.....	72½	A. B.	Tucson
Martin, Mary C.....	5	B. S. (H. E.)	Tucson
Mashbir, Blanche B.....		U.	Tucson
Matthew, John, Jr.....	19	B. S. (E. E.)	Tucson
Meyer, Richard.....	60	B. S. (Mining)	Tucson
Miller, Helen.....	2	U.	Tucson
Middleton, J. T.....	15	A. B.	Edinburg, Ind.
Miller, Uretta.....	15	A. B.	Tucson
Miller, Marion.....	7	A. B.	Tucson
Minor, Bert.....	117¼	B. S. (Agr.)	Phoenix
Minister, Percy F.....	35½	G. (Chem.)	Hesperia, Cal.
Monro, Elbert C.....	69	A. B.	Pasadena, Cal.
Moore, Percy W.....		G. (Agr.)	Media, Pa.
Moeur, John K.....		B. S.	Tempe
Morse, Starling M.....		G.	
Morse, Mrs. Stanley F.....		U.	Tucson
Muirhead, Coral.....	51	A. B.	Bisbee
Murphy, Elizabeth M.....	18	G.	Tucson
Murphey, Mrs. W. E.....	16	U. (H. E.)	Tucson
Mustain, Grace A.....		U.	Tucson
Neal, Elsie H.....	86	A. B.	Tucson
Nelson, C. O.....	9	B. S.	Prescott
Odell, Mabel S.....	87	A. B.	Tucson
O'Keefe, John J.....	16	B. S. (Con.)	Nogales
O'Keefe, Charles C.....	17	B. S. (Mining)	Nogales
Olcott, Arthur W. Jr.....		U.	Tucson
Oxley, Edward.....	137	B. S. (Agr.)	Charlestown, W. Va.
Parker, Grace.....	47	A. B.	Tucson
Parke, Leonard E.....	13	B. S. (Agr.)	Paulina, Ia.
Patel, Govindjee Naranjee.....	111	B. S. (Agr.)	Bombay, Ind.
Patterson, Carroll E.....		B. S. (Mining)	Omaha, Neb.
Peabody, Russell.....	39	B. S. (Mining)	Phoenix
Penrod, Temple F.....	19	B. S.	Winslow
Phelps, Wilford.....	19	B. S. (E. E.)	Mesa
Phillips, Yousta S.....	16	B. S. (M. E.)	Tempe
Phillips, Priscilla.....	15	A. B.	Thatcher
Phillipson, Mary T.....	4	U.	Tucson
Pickrell, Watson W.....	118¼	B. S. (Agr.)	Phoenix
Pickrell, Charles U.....	71	B. S. (Agr.)	Phoenix
Pilcher, Cornelia B.....	13	B. S.	Tucson
Pistor, Anna F.....	146	A. B.	Tucson
Pistor, Carl.....	112	B. S.	Tucson
Pistor, Fritz M.....	14	B. S.	Tucson
Pitrat, Julius E.....	50	B. S.	Phoenix
Porter, Asa.....	120	B. S.	El Paso, Tex.
Porter, Carter.....	8	B. S.	El Paso, Tex.
Post, Anita C.....		G.	Yuma
Prouty, Victor.....	34	B. S. (C. E.)	Tucson
Rae, Jesse.....	15	A. B.	Vail
Rebeil, Anita L.....		A. B.	Tucson
Rebeil, Leonie C.....	7	A. B.	Tucson

NAME	UNITS	COURSE	
Reed, Ruth .....	56	B. S. (H. E.) .....	Phoenix
Reese, Ursilla .....	13	B. S. ....	Bisbee
Renaud, Ernest J.....	79½	B. S. ....	Pearce
Renaud, Charles L.....	60	B. S. (M. E.) .....	Pearce
Rider, Jane H.....		G. ....	Tucson
Rider, Percy S .....	11	B. S. ....	Tucson
Robie, Wendell .....	61	B. S. ....	Berkeley, Cal.
Rockfellow, Henrietta .....	15	A. B. ....	Cochise
Rodee, Nona C.....	122	A. B. ....	Tucson
Rogers, David W.....	37	B. S. ....	Pima
Rolph, Inez Katherine.....	117	A. B. ....	Streator, Ill.
Ronstadt, Fred A.....	17	B. S. (Agr.) .....	Tucson
Rubel, Albert C.....	106	B. S. (Mining) .....	Indianapolis, Ind.
Ruppert, Carl .....	58	B. S. (Agr.) .....	Phoenix
Russ, Ralph F.....	78	B. S. (E. E.) .....	Harrisburg, Pa.
Russell, Ernest E.....	35	B. S. (Agr.) .....	Tucson
Ryan, Albert E.....	46	B. S. (E. E.) .....	Morenci
Ryan, Patrick Daniel.....	10	B. S. (Com.) .....	Tucson
Ryder, Eugene M.....		B. S. ....	Long Beach, Cal.
Ryder, Donaldson .....	13	B. S. (Agr.) .....	Phoenix
Saelid, Althea .....	16	A. B. ....	Warren
Sanderson, Murray .....	21	A. B. ....	Douglas
Sawtelle, Marion .....		G. ....	Tucson
Schaussen, von Dwight Lewis.....	88	A. B. ....	Philadelphia, Pa.
Scheidemann, Laura .....	16	A. B. ....	Clarie, Ia.
Scheidemann, Norma .....	16	A. B. ....	Clarie, Ia.
Scheerer, Cedric E.....	90	B. S. (C. E.) .....	Tucson
Scheerer, George W.....	133½	B. S. (Agric.) .....	Douglas
Schon, Auguste L.....	102¼	B. S. ....	Luxembourg
Schreiner, T. E.....	83	B. S. (Agr.) .....	Tucson
Schwalen, Harold .....	102½	B. S. (M. E.) .....	Tucson
Schwalen, Irma M.....	16	B. S. (H. E.) .....	Tucson
Schwartz, Elizabeth .....		U. ....	Tucson
Seeley, George W.....	52	B. S. (M. E.) .....	Douglas
Sessions, Alma P.....	121¾	B. S. (E. E.) .....	Thatcher
Shappell, Maple DeLos.....	8	A. B. ....	Oak Park, Ill.
Sible, Cecil .....		B. S. ....	Churubusco, Ind.
Sloanker, Harold S.....	4	B. S. (Mining) .....	Pittsburg, Pa.
Smith, Turner C.....	124¼	B. S. (M. E.) .....	Globe
Smith, Winifred O.....	10	A. B. ....	Globe
Sneed, Ella .....	11	A. B. ....	Hereford
Spies, Ethel M.....	67	A. B. ....	Tucson
Sprague, Marietta T.....	3	G. ....	Tucson
Stander, Henrique J.....	15	G. (Mining) .....	So. Africa
Steger, Adelaide L.....	53	A. B. ....	Tucson
Steingger, William S.....	129	B. S. (E. E.) .....	Phoenix
Steele, Lucille .....	16	B. S. (H. E.) .....	Tucson
Stevens, Charles S.....	12	B. S. ....	Douglas
Stultz, R. ....		U. ....	Tucson
Sweet, Sanford .....	48	B. S. (E. E.) .....	Phoenix
Swaney, Oscar .....	56	B. S. ....	Tucson
Tenley, Raymond E.....	17	B. S. ....	Willcox
Tompkins, Edith .....	90	A. B. (Music) .....	Tucson

NAME	UNITS	COURSE	
Tong, James A.....	48	B. S. (C. E.)	Johnson
Thorner, Harriet B.....	122	B. S. (Biology)	Tucson
Thrift, Inez E.....	123	A. B. (English)	Phoenix
Turnbull, Charles C.....	88	B. S. (Soc. Sc.)	Cuddo, Okla.
Turnbull, Mary M.....	106	A. B.	Cuddo, Okla.
Turvey, Harry E.....	64	B. S. (Mining)	Douglas
Twedell, Gladys.....	17	A. B.	Phoenix
Upshaw, Ernest M.....	12	B. S. (Com.)	Tucson
Vance, Calvert L.....	61	B. S. (Agr.)	Casa Grande
Vaughan, Wallace W.....	68	A. B.	Bisbee
Vaughan, Harwood A.....	18	B. S. (Com.)	Bisbee
Voller, John W.....	109 $\frac{1}{4}$	B. S. (C. E.)	Tucson
Vinson, Katherine.....	54	A. B.	Tucson
Vosskuehler, Max.....	15	B. S. (Mining)	Phoenix
Wade, Ethel.....		U.	Tucson
Walker, Suzanne F.....		U.	Tucson
Walker, J. Franklin.....	11	G. (Educa.)	Anaheim, Cal.
Waters, Josephine.....	90	A. B. (Math.)	Douglas
Warner, Albert.....	62 $\frac{1}{4}$	B. S. (Eco.)	Tucson
Weber, Ralph E.....	18	B. S. (E. E.)	Winslow
Wells, Hilda H.....		U.	Tucson
Westover, Harry E.....	44	A. B. (Law)	Yuma
Westover, Willie H.....	45	A. B. (Law)	Yuma
Wetencamp, Paul F.....	118 $\frac{1}{2}$	B. S. (M. E.)	Warren
Whipp, Homer.....	49 $\frac{1}{2}$	B. S. (M. E.)	Pomona, Cal.
Whisler, Lois G.....	122	A. B. (English)	Tucson
White, Arthur L.....	55	B. S. (Mining)	Bisbee
Whitehead, Lawrence G.....	48	B. S. (Agr.)	Indianapolis, Ind.
Whitney, Hazel Catherine.....		U.	Tucson
Whysall, Ruth M.....		G.	Marion, Ohio
Wikoff, Charles E. G.....	34	B. S. (Mining)	Phoenix
Wight, Roy.....		B. S. (M. E.)	Alexandria, N. Y.
Wilky, Frank H.....	12	B. S. (E. E.)	Phoenix
Williams, Tenney.....		G.	Tucson
Williams, Mrs. Mabelle N.....		U.	Tucson
Wilson, Dorothy Knox.....	5	A. B.	Binghampton, N. Y.
Wilson, Robert.....	11	B. S. (M. E.)	Tucson
Wilson David E.....	14	B. S. (Chem.)	Phoenix
Wilson, Clarence P.....			Omaha, Neb.
Windsor, Elsie.....	37	A. B. (English)	Willcox
Winsett, Alfred I.....		A. B.	Mulberry, Ark.
Woolf, Jesse A.....	52	B. S. (Mining)	Tempe
Wright, Elwood W.....		B. S. (Agr.)	Berkeley, Cal.
Wright, Esther.....	85	B. S. (H. E.)	Phoenix
Woods, Gladys.....	7	A. B.	Bisbee
Zeitlin, Albert.....	21	A. B.	Douglas

## SPECIAL STUDENTS

Armstrong, Mrs. Martha.....	1.....	Tucson
Aros, Gustave C.....	7.....	Tucson
Berry, C. ....	.....	Tucson
Barth, Maurice .....	5.....	St. Johns
Blackmer, Elmer .....	7.....	Buckeye
Blair, Frances B.....	4.....	Tucson
Benton, Almena M.....	.....	Tucson
Binns, Biddie M.....	.....	Tucson
Bowen, Paul A.....	.....	Denver, Colo.
Brinegan, Thos. R. ....	.....	Tucson
Brooks, Mrs. Byrd.....	.....	Tucson
Burgwin, Pearce .....	.....	Greenville
Carter, Ralph C.....	16.....	Tucson
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Clark, Frank M.....	.....	Tucson
Clark, Gladys M.....	10.....	Tucson
Clark, Edward .....	.....	Tucson
Cochran, Mrs. Daisy B.....	.....	Tucson
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Cherry, Mrs. A. B.....	3.....	Tucson
Childs, Louis .....	.....	Tucson
Cummings, Malcolm B.....	2.....	Tucson
Crumm, Mrs. F. E.....	2.....	Tucson
Davis, Carl A.....	.....	Tucson
Diggins, Michael J .....	.....	Tucson
Dodge, Mrs. Julia.....	2.....	Tucson
Dow, Mrs. E. A.....	.....	Tucson
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Duff, Mrs. Thos. A.....	.....	Tucson
Durazo, Othlia M.....	.....	Tucson
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Ferguson, Alice A.....	4.....	Tucson
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Grossetta Dan .....	0.....	Tucson
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Heidel, Mamie .....	1.....	Tucson
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Hort, Lester B.....	.....	Tucson

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Klein, John J. ....		Tucson
Knapp, Miles .....	17	Rillito
Langworthy, Ralph W. ....		Tucson
Leon, Cleopha M. ....		Tucson
Lloyd, Llewellyn .....		Los Angeles, Cal.
Lamb, Carl G.....		Tucson
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Manson, C. O.....		Tucson
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McWade, S. G. ....		Tucson
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McKenzie, Fred W.....		Tucson
Macia, James Herbert.....		Tucson
Mack, Betty .....	2	Tucson
Manzo, Rudolph .....		Tucson
Midhardt, Mira A.....	2	Tucson
Miller, Constance .....		Tucson
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Minsham, James R. ....		Tucson
Moore, Catherine I.....	5	Tucson
Moore, L. G. ....		Tucson
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Mowry, Clarence .....		Tucson
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Pankey, Philip S. ....		Tucson
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Richardson, Mrs. Minnie.....		Tucson
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Seright, Herbert E. ....		England
Shaafter, David I. ....		Tucson



Slavino, Jos. ....	.....	Tucson
Solberg, William C. ....	.....	Tucson
Spaulding, A. W. ....	.....	Tucson
Sprague, Verra N. ....	.....	Tucson
Strauss, Hattie ....	.....	Tucson
Swan, Mrs. Stella M. ....	2.....	Tucson
Thomas, Lillian ....	.....	Tucson
Thomas, Sudie ....	.....	Tucson
Vincent, William A. ....	.....	Tucson
Weeks, Ruth ....	.....	Tucson
Whiteside, Thomas S. ....	35.....	Chattanooga, Tenn.
White, Theresa ....	.....	Tucson
Willcox, Leta M. ....	.....	Tucson
Wilson, Frank ....	.....	Tucson
Zeigle, Harold D. ....	.....	Tucson

## REGULAR STUDENTS

CLASS	MEN	WOMEN	TOTAL
Graduate Students .....	16	8	24
Seniors .....	25	14	39
Juniors .....	35	13	48
Sophomores .....	54	13	67
Freshmen .....	65	35	100
Unclassified .....	14	58	72
Total Regular Students .....	209	141	350

## SPECIAL STUDENTS

CLASS	MEN	WOMEN	TOTAL
Specials .....	60	53	113

## SHORT COURSE STUDENTS

CLASS	MEN	WOMEN	TOTAL
Farmers .....	128		128
Domestic Science .....		35	35

## CORRESPONDENCE STUDENTS

	MEN	WOMEN	TOTAL
	5	2	7
Total Registration .....	402	231	633

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